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ABSTRACT

This document reports on the evaluation study of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) 1993 Summer Institutes that provided opportunities for teachers from around the country to participate in hands-on education programs in areas such as environmental and ecological studies, material science, space research, and alternative energy and conservation studies. Part I of the report details the findings of the evaluation study. The Institutes provided significant enrichment in science and related content areas but did not explore innovations in instruction or reflect current research on theories of learning. Part II of this report addresses the follow-up projects that were intended to support teachers as they transferred their new knowledge to the classroom and provide them with additional materials and equipment. Part III details the recommendations resulting from the evaluation study of the Summer Institutes and the follow-up projects. Recommendation themes include program administration, promoting a new vision of classroom teaching and learning, teacher development and program activities, follow-up, teacher leadership and responsibility, and program evaluation. Appendices contain data collection methods and survey instruments. (JRH)

# The National Center for Improving Science Education

ED 409 160

# EVALUATION REPORT:

# FCCSET/DOE
# 1993 Summer Institutes



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A DIVISION OF THE NETWORK, INC.

sponsored by the National Science Foundation



The NETWORK Inc.

# EVALUATION REPORT:

# FCCSET/DOE 1993 Summer Institutes

***DECEMBER 1994***

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# EVALUATION REPORT:

# FCCSET/DOE 1993 Summer Institutes

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# EXECUTIVE SUMMARY

This document is a report on the evaluation study[1] of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) 1993 Summer Institutes. Under the general supervision of the U.S. Department of Energy (DOE), 15 Summer Institutes for teachers were held across the U.S. in the summer of 1993. The Summer Teacher Enhancement Programs (STEP), known as Summer Institutes, provided opportunities for teachers from around the country to study at federal facilities. The participants spent four weeks in hands-on education programs in such varied areas as: environmental and ecological studies, material science, space research, and alternative energy and conservation. All the Institutes had the goal of improving middle school/junior high and/or high school science learning by enhancing the science knowledge of teachers through in-depth training. The specific topics covered varied from site to site. These Summer Institutes represented a significant federal investment in teacher professional development, focusing on increasing the knowledge base of 560 teachers.

The federal facilities' employees who organized and carried out the Summer Institutes included education specialists, scientists, and technical staff. In a number of cases, outside presenters drawn from higher education, other federal facilities, or state agencies, provided expertise that was not available within the Lab itself.

Participating teachers were chosen from pools of applicants either within the state in which the Lab was located or within a multi-state region. The time line between funding and start-up was very short, which meant the pool of applicants was quite small at many of the sites, resulting in low enrollments at some sites. The majority of participants were high school science teachers, with the next largest group being middle school/junior high teachers. Some Institutes included elementary teachers; one Institute had a majority of participants from elementary schools.

Part I of this report details the findings of the evaluation study conducted during the Summer of 1993. All 15 Summer Institute sites were visited by staff or associates of the National Center for Improving Science Education (NCISE). Observations, data collection, and interviews conducted by this team followed a "Template for Teacher

[1]This study evaluated Summer Institutes for teachers that were initiated by the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), now the National Science and Technology Council (NSTC), and its committee on Education and Training. Under the guidance of the Subcommittee for Excellence in Science, Mathematics and Engineering Education and sponsored by the National Science Foundation (NSF) the study was designed and monitored by the Dissemination and Evaluation Working Group for the NSTC and carried out by the National Center for Improving Science Education (NCISE), at The NETWORK, Inc.

Development Programs" created by NCISE in collaboration with DOE staff. This format enabled uniform observations of the Summer Institutes and their participants.

All of the 15 Summer Institutes carried out follow-up work with some or all of the teachers who attended the summer sessions. The follow-up was intended to support teachers as they transferred their new knowledge to the classroom and to provide them with additional materials and equipment. Part II of the report addresses these efforts by the various projects. Follow-up was observed during eight site visits to the projects that included in-person interviews with teacher participants and Institute staff during the 1993-94 school year. In addition, telephone interviews with 63 teacher participants and all 15 Institute Directors were used to gather information concerning follow-up.

Part III of the report details the recommendations resulting from NCISE's Evaluation Study of both the Summer Institutes which occurred in 1993 and their follow-up activities that subsequently took place in 1993 and 1994.

## GENERAL FINDINGS FROM THE EVALUATION STUDY OF THE 1993 SUMMER INSTITUTES

- The unique role that the federal Labs and facilities play in cutting-edge research in science, mathematics, and engineering technology and the wealth of knowledge located at these sites provided participating science and mathematics teachers with the opportunity to engage in the latest developments in science and contemporary research.

- The 15 Summer Institutes drew upon the substantial human and physical resources at the federal facilities where they were held. Some of the Labs were better suited than others to support the participating teachers full engagement in the research. This depended upon the level of complexity of the science being studied and the accessibility of the research facility itself. If laboratory spaces were off limits because of hazards such as radioactivity or operational needs such as clean rooms, it became harder for teachers to experience and comprehend the work of the facility.

- The Institutes provided significant enrichment in science and related content areas, updating teachers' knowledge base in such varied areas as: environmental and ecological studies, material science, space research, and alternative energy and conservation.

- Institute organizers and staff did not clearly articulate a *vision* of what effective science and mathematics teaching should look like in the participating teachers classrooms, after the Institute. Institutes, while well-regarded by participants, generally did not explore innovations in *instruction* or reflect current research on *theories of learning*. The Institutes tended to emphasize science content, often in relatively narrow fields. While the exposure to such content was either a new or enriching experience for the participating teachers, they were not consistently offered a means to translate that to effective classroom practice. In fact, very few Institute instructors had experience in schools or were knowledgeable about the current research on learning and methods of science instruction.

- Lead time for recruitment and enrollment in the Institutes was inadequate, through no fault of the Institutes themselves.

- Participants reflected the regional population in terms of ethnicity, urban/rural, and income levels, since participants were generally drawn from the geographic region of the federal Lab involved.

## FINDINGS FROM THE STUDY OF FOLLOW-UP ACTIVITIES CONDUCTED DURING THE SPRING AND SUMMER OF 1994

- Every Institute planned some type of follow-up, but many felt unable to provide extensive follow-up due to limited resources and staff time. Lab and facilities staff expressed their determination to make provisions for more intensive follow-up in future Summer Institutes.

- Teachers who attended Institutes that incorporated follow-up as an integral part of their complete program tended to be more active in incorporating material learned during the summer than those teachers who attended Institutes that did not place a strong emphasis on follow-up. During at least four of the follow-up site visits, and in 15% of all the teacher telephone interviews, participants spoke of the significance of the follow-up process and the enthusiasm generated.

- Even when follow-up was a *minor* component of the Institute, it was helpful to the teachers who participated. Several individuals pointed to the value of informal, teacher-to-teacher networking that was made possible by the Institutes and reinforced by the follow-up process.

- Most of the Institutes were not able to generate a sense of on-going connectedness or partnership with their 1993 teacher participants because they did not have the ability to create on-going networks of practitioners, either through repeated face-to-face meetings or telecommunications.

- Electronic communication, proposed or assumed by all of the 15 Institutes, was limited largely because of technological limitations on the part of participants' schools.

## RECOMMENDATIONS

Specific recommendations for the Funding Agency and those administering the Summer Institutes are grouped under the respective components of the "Template for Teacher Development Programs" in Part III of the report. They are summarized thematically in this executive summary.

### Program Administration

Continue the funding of teacher enhancement Summer Institutes in the Federal Laboratories and facilities. However, explore better targeting of participants for the Institutes, both in background and roles to be played in their schools matched to Institute goals. Make certain that there is adequate time for recruiting participants and planning of the Institutes.

### Promoting a New Vision of Classroom Teaching and Learning

Articulate and communicate a vision of how learning and teaching of science can look in the classroom that reflects emerging national standards. Involve teachers and external presenters, as well as staff, in planning and communicating this vision.

### Teacher Development Program Activities

Model effective teaching practices in the Institutes that participants will be expected to use with their students. Provide a range of experiences for the participants that will encourage creativity and a spirit of cooperative inquiry. Formats other than 20 day Institutes should be considered to foster these goals.

### Uniqueness of the DOE Laboratories and Other Federal Facilities

Continue to share with the science and mathematics teachers the unique science research skills possessed by the staff in the Labs and other federal facilities.

### Follow-up

Plan effective continuous follow-up that ensures a lasting relationship between the participants and the Lab and other federal facilities staff. Follow-up should include hands-on activities easily transferred to the classroom. Be certain that mechanisms for follow-up, including telecommunications are available for use by participants in their schools.

### Teacher Leadership and Responsibility

Actively engage the participating teachers in the Institute's planning and follow-up process.

### Program Evaluation

Continue to engage in modifying the program's design and delivery based on feedback from participants and Lab and other federal facilities staff. Evaluate the Institute's effects on participants' knowledge, attitude, and classroom practice.

# SUMMER INSTITUTES FOR EDUCATORS

This report summarizes the findings and recommendations developed from the evaluation of the 1993 FCCSET Summer Institutes. It is organized in three parts: Part I - The evaluation of the 1993 Summer Institutes; Part II - The evaluation of the 1993 Summer Institutes Follow-up Activities; and Part III - The Recommendations resulting from both of these studies.

Parts I and II each discuss the background, data collection and evaluation, and findings.

## PART I — EVALUATION OF 1993 SUMMER INSTITUTES

### BACKGROUND

Part I of this report draws together the evaluations of 15 Summer Institutes for teachers held in June, July, and August of 1993 under guidelines and funding made available through the Federal Coordinating Council for Science, Engineering and Technology (FCCSET), now the National Science and Technology Council (NSTC). The Institutes were coordinated by the US Department of Energy (DOE). This study was sponsored by the National Science Foundation (NSF) and designed and monitored by the Dissemination and Evaluation Working Group for the NSTC and carried out by the National Center for Improving Science Education (NCISE) of The NETWORK, Inc.

The Summer Teacher Enhancement Programs (STEP), known as Summer Institutes, provided opportunities for teachers from around the country to study at federal facilities. They spent four weeks in hands-on education programs in such varied areas as: environmental and ecological studies, material science, space research, and alternative energy and conservation. These Institutes drew on the wealth of scientific, technological, and human resources at host facilities across the nation and offered teachers the opportunity to deepen their knowledge in specific disciplinary areas.

The goal of the 1993 Summer Institutes was to improve middle school/junior high and/or high school science learning by enhancing the science knowledge of teachers, already teaching science, through in-depth training. The Summer Institutes provided professional development for 560 teachers from 22 states and the District of Columbia in DOE Laboratories and other federal facilities throughout the country (see Appendix A).

Different STEP program designs addressed different needs of teachers; some aimed to give teachers who did not have a strong science background the exposure that helped improve their ability and confidence to teach innovative, effective science courses. Other STEP programs addressed teachers who were comfortable teaching science in high school. These latter programs assumed a strong science background and sought to enhance teachers' knowledge of the latest advances in research.

Additionally, some STEP Institutes provided teachers an opportunity to incorporate new information and teaching strategies into curricula and materials that helped them model the processes of technological innovation coupled with scientific discovery. Participants interacted with scientific and technical professionals, in laboratories, lectures, and in designing and conducting research experiments. In many cases these STEP experiences were the first opportunity participating teachers had to experience science and technology with cutting-edge scientists. Examples included:

- building a cosmic ray telescope (at DOE's Superconducting Supercollider Laboratory)

- conducting research on magnetic fields present in a test bed and using a scanning electron microscope (at DOE's Continuous Electron Beam Accelerator Facility)

- tree coring and preparing the cores for research (at the Department of the Interior's National Wetlands Research Center).

Almost all of the Summer Institutes also drew upon additional presenters from such places as: institutions of higher education; varied research facilities; science and technology museums; and other resource centers.

> *Please note: For the purposes of this report, the authors do not identify specific sites, participants, or staff members. The intent of the report is to reflect upon the Institutes as a whole, not as separate entities.*

**Program Administration**

*Requests for Proposals*

In December 1992, staff personnel from various federal Laboratories met to discuss the new FCCSET Initiative that had as its purpose:

> *to expand content knowledge and enhance pedagogical skills of teachers through participation in Summer Institutes.*

They were invited to submit proposals. The emphasis was clearly on summer programs and on a 20-day (four week) Summer Institute as the delivery system. Follow-up was called for, but the idea of recruiting teams or of testing various delivery systems to support innovation in middle/junior high and high school classrooms was not mentioned in the RFP. Ways to link the goals and objectives of the Institute to reform efforts were addressed in the RFP, using examples such as the NSF's Statewide Systemic Initiatives. Federal Laboratories and others applying for the grants were asked to state how school systems would support teachers participating in the Institute, but there were no apparent requirements that the school districts make significant contributions to this follow-up support (see Appendix B).

### *Institutes Selected for Awards*

Funding was awarded to 15 programs. Of the 15 programs, 14 were *effectively* first year projects and, therefore, under development as they took place. Even though some of the projects grew from earlier professional development efforts, they can be studied as first year efforts because they had to be adapted to fit the characteristic guidelines as delineated in the letter accompanying the Application Form (see Appendix B). For example:

- Marshall Space Flight Center (Huntsville, AL) had run eight-week sessions, but never four-week events.
- The Smithsonian (Washington, DC) substantially revamped their Institute as did the NASA Jet Propulsion Laboratory (Pasadena, CA).
- Continuous Electron Beam Accelerator Facility (Newport News, VA) restructured an earlier plan for an Institute.

Of the 15 projects, only one ran a program that they had offered several times before, with the same materials, time line, and overall structure.

### *Sites and Institutes*

A variety of federal facilities were involved in this process in 1993, including:

- Argonne National Laboratory (DOE), Argonne, Illinois - "FCCSET Summer Teacher Enhancement Institute"
- Lawrence Berkeley Laboratory (DOE), Berkeley, California - "Science and Society Teacher Institute"
- Clemson University and Pee Dee Research and Education Center (Agricultural Experiment Station, US Department of Agriculture), Florence, South Carolina - "PEAK (Professional Educators Access to Knowledge) Institute for Science in Agriculture"
- Continuous Electron Beam Accelerator Facility (DOE), Newport News, Virginia - "Summer Institute for Teacher Enhancement"
- Environmental Protection Agency and Miami University, Cincinnati, Ohio - "Hands-On Environmental Science"
- NASA Jet Propulsion Laboratories, Pasadena, California - "Teacher Enhancement Program"
- NASA Marshall Space Flight Center, Huntsville, Alabama - "Summer Teacher Enrichment Program"

- NOAA Laboratory (Department of Commerce), Boulder, Colorado - "NOAA (National Oceanographic and Atmospheric Administration) Summer Science Institute"

- National Wetlands Research Center (US Fish and Wildlife Service, Department of the Interior) and University of Southwestern Louisiana, Lafayette, Louisiana - "Microscopy of the Wetlands"

- Oak Ridge Laboratory (DOE), Oak Ridge, Tennessee - "Restoring Our Waters Teacher Institute"

- Pacific Northwest Laboratory (DOE), Richland, Washington - "National Teacher Institute in Materials Science and Technology"

- Sandia National Laboratory (DOE), Albuquerque, New Mexico - "GANAS" (Gaining Access to Natural Abilities in Science)

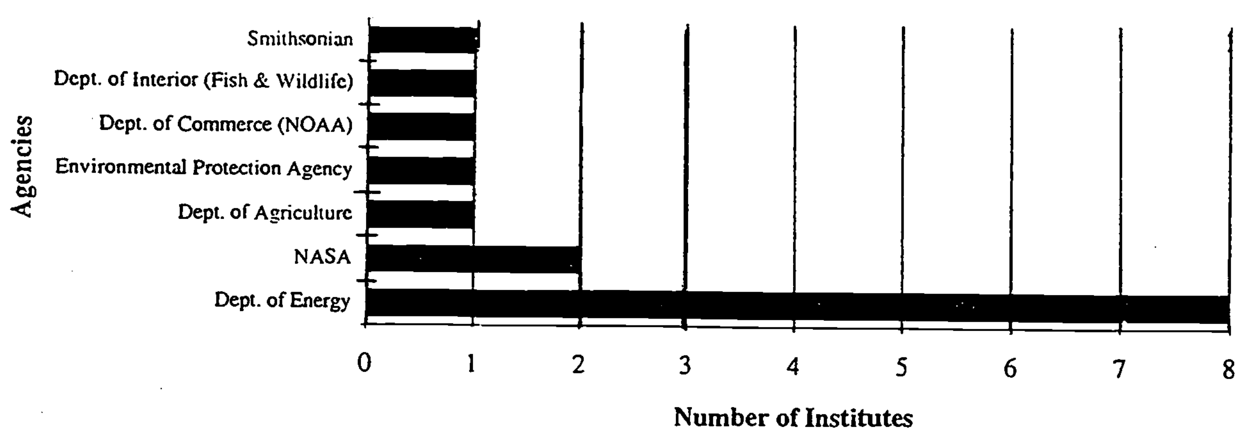
- Sandia National Laboratory (DOE), Livermore, California - "SUPER" (Science Understanding Promotes Environmental Responsibility)

- Smithsonian Institution, Washington, DC - "Natural Science Institute for Teachers of Minority Students"

- Superconducting Supercollider Laboratory (DOE), Dallas, Texas - "Summer Institute for Physics and Physical Science"

A distribution of Institutes by agency appears in Figure 1.

Figure 1: Distribution of Institutes by Agency




The fact that eight of the 15 funded sites were DOE sites reflects the fact that the majority of the proposals in response to the RFP were from DOE sites as well as the fact that the DOE Labs best met the RFP requirements based upon a panel review by experts in the area of teacher development.

Announcement of grant awards to the Labs and facilities was late; this foreshortened their recruiting resulting in some projects running with an enrollment under their authorized 50 participants.

The Institutes all recruited public school teachers through announcements, fliers, and word of mouth in the spring of 1993. They were offered a summer experience of three or four weeks duration. Days were full, eight hours or more, with some evening sessions as well. Most Institutes met at federal facilities using classroom/conference spaces. Several Institutes made residential arrangements for at least some participants, while at others, teachers commuted or made their own housing arrangements.

### *Budget Summary*

The grant awards for all 15 of the sites totaled $3,387,934. The smallest grant was $54,000 and the largest was $307,000. Stipends paid to teachers during the Summer Institutes exceeded $650,000. In virtually all cases, the budgets included funding for travel and other costs related to follow-up. Therefore, the funds expended per participant provided for some professional development beyond the four week Summer Institutes (see Figure 2).

While original projections had hoped for a maximum attendance of 750 teachers, the actual attendance was 560 teachers at the 15 sites. This resulted in an average cost per teacher of $6,050. Had it been possible to fully enroll all Institutes, the cost per teacher would have dropped to $4,517.

This figure reflects only the site costs for provision of the Institute and follow-up. It does not take into account in-kind contributions by the individual federal facility or the administrative costs incurred by DOE or the costs of evaluation. These figures are exclusive of the DOE administrative overhead costs which were not contained in the site-by-site data.

**Figure 2. Number of Teachers and Amount of Spending**

| | Anticipated Enrollment* | Actual Enrollment** |
|---|---|---|
| Total Number of Teachers | 750 | 560 |
| Teachers per Institute | 50 | 37 |
| Total Amount of Money | $3,387,934 | $3,387,934 |
| Cost per Teacher | $4,517 | $6,050 |

* 15 Institutes with 50 each
** 15 Institutes with average of 37 each

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## DATA COLLECTION AND EVALUATION PROCESS

### The Template for Teacher Development

To profile the 15 Summer Institutes a "Template for Teacher Development Programs" (see Appendix C) was used by project staff and site visitors. The template was developed by the National Center for Improving Science Education (NCISE), in collaboration with staff from various DOE Labs. Data from the template documents were coded and analyzed, along with other documentation, to prepare this report. The guidelines for use of the template (*Profiling Teacher Development Programs: An Approach to Formative Evaluation.* NCISE 1993, 4) state:

> The purpose of profiling is to get a picture of what a program intends to do and what it actually does, in a way that enables comparison to best practice. The primary tool is the program template, which depicts the components of best practice (derived from both research and experience) and allows for description of a particular program in terms of those components.
>
> A completed template allows program managers to address the following questions:
>
> 1. What is best practice in teacher development programs?
> 2. To what extent is our program designed to reflect best practice?
> 3. To what extent does our program actually reflect best practice?
> 4. To what extent is the program's design actually carried out?
> 5. Where are the gaps? What can be improved?

Working on behalf of the National Center for Improving Science Education, nine site visitors made trips to the Institutes (see Appendix D). Each Institute hosted at least one visitor (some hosted two) for approximately two days, typically during the last week of the Institute (or within the last 30% of the contact hours of the program).

In terms of direct observation, these site visitors saw only the summer portion of the program. They were able to learn about *planning* for a variety of follow-up activities, but they did not directly *observe* any follow-up as it had not yet occurred. In Part I of this report, all comments about follow-up relate to *planning* of the follow-up and not to direct observation of those later activities. Part II addresses the implementation of the follow-up.

### Data Collection and Tabulation Using the Template

Institute directors received training in the application of this template during the spring of 1993. They recorded elements of their program design in a category called "***Intended***" which paralleled a list of specific "***Components of Effective Practice***," derived from research, literature, and best practice (see Appendix C). The site visitor then entered observations for each of the intended items under a parallel column

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labeled "*Actual.*" These site visitors, using a combination of observation, informal discussion, and formal interviews with participants and staff were able to capture a "snapshot" of the state of the Summer Institute at the time the visit took place. Project directors also supplied additional background data through a "Descriptive and Context Information Sheet" (see Appendix C, FCCSET.TEM-9).

### Data Collection and Tabulation Using Pre- and Post-Surveys

Further data were gathered through a **"Pre-Participant Information Sheet,"** hereafter referred to as Pre-Survey, and a **"Program Evaluation Form,"** hereafter referred to as Post-Survey, in which several of the same questions were asked, allowing for comparison and evaluation across the full breadth of each of the Summer Institutes (see Appendix E and F). Response rate to the Surveys was close to 60%

## FINDINGS USING THE TEMPLATE

Findings from the Summer Institutes evaluation study are organized by the seven components of effective practice found on "The Template for Teacher Development." These are:

- Program Administration
- Promoting a New Vision of Classroom Teaching and Learning
- Teacher Development Program Activities
- Uniqueness of the DOE Laboratories and Other Federal Facilities
- Follow-Up
- Teacher Leadership and Responsibility
- Program Evaluation

### Component 1 — Program Administration

*This component includes the clarity of program goals, the recruitment process, pre-program interaction and the inclusion of "teachers, scientists, educators and administrators in program design."*

For each of the Institutes, the *"Intended"* column expanded upon the specifics that the program staff planned and carried out for each of the 11 identified elements of

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program administration. In virtually every case, the site visitors were able to confirm whether these items had been addressed and successfully carried out before and during the Institute. In every Institute, limited recruiting time made the pre-program efforts less substantial and less successful than the Institute staffs had hoped for.

Clear program goals were reported by site visitors at all but one Institute and a majority of participants at each Institute indicated their understanding of the goals. However, at every Institute there were some people who were not clear on the program goals or who felt there was some confusion in this area. Data from pre- and post-surveys indicate a need for improvement of advance communication prior to the start of (or enrollment in) the Institutes. Some of this can clearly be attributed to the first-year nature of these projects.

### *Internal administration*

The site visitors found that the internal program administration of the Institutes was well organized. All of the Institutes found ways to involve their own program staffs and some Lab scientists in program design. Staff at many Institutes met on a regular basis during the three to four weeks of the sessions, and followed up on coordination details including outside presenters, resource materials, and the mentor relationships with scientists and other researchers. Few Institutes included teachers and school administrators in this design process.

### *Inclusion of school administrators*

Four Institutes actively worked to involve school administrators for at least a modest portion of the Institute. One Institute was successful in getting an administrator to serve on each team. Aside from the program that included administrators on teams, the highest level of administrator participation in a portion of any Institute was 40% (in relation to the numbers of teachers enrolled in the Institute). Eleven Institutes did not link to administrators beyond obtaining written confirmation of teachers' participation and an agreement to allow limited follow-up (see Appendix C, FCCSET.TEM-4).

### *Selection process*

The time line between funding and start-up was very short, which meant the pool of applicants was quite small at many of the sites, resulting in low enrollments at some sites. The majority of participants were high school science teachers, with the next largest group being middle school/junior high teachers. Some Institutes included elementary teachers with one Institute having a majority of participants from elementary schools.

Many of the Institutes had participants with varying skills. One Institute served senior high physics teachers and teachers of 9th grade physical science whose backgrounds in physics were quite different. There were suggestions that groups be separated by knowledge levels and that there be prerequisites for Institutes. Several teachers commented that the selection process should also consider the leadership abilities and skills of the teachers in *implementation* of curriculum reform at the school district level. Teachers who are leaders would be able to contribute an understanding of such new efforts as: integrated and coordinated curricula at the high school level, problem solving skills at all levels, and how students can best move from concrete hands-on work to greater abstractions.

**Component 2 — Promoting a New Vision of Classroom Teaching and Learning**

*"Promoting a New Vision" refers to the kind of science program labs want teachers to use with their students. It relates to the vision of teaching and learning embedded in the Institute; what the Institute hopes teachers will be able to accomplish in their classrooms; the on-going assessment of science learning; and the use of materials, strategies, and perspectives sensitive to diverse cultures, languages, genders, and learning styles.*

Many Institutes involved extensive content learning with detailed examination of the topics covered. It was less clear to site visitors that the Institutes promoted new approaches to student learning such that they would be better able to solve problems and develop habits of inquiry. Several site visitors repeated the observation that, "a new vision of the school and classroom generally is not emphasized." Very few Institute instructors had experience in schools or were knowledgeable about the current research on learning and methods of science instruction. Therefore, the Institutes tended to emphasize science content, often in relatively narrow fields. While the exposure to such content was either a new or enriching experience for the participating teachers, they were not consistently offered a means to translate it to effective classroom practice. This is a significant issue that must be addressed by Summer Institutes in the future.

One site visitor observed that a Summer Institute:

> offered extensive new content aimed at supporting high school physics teachers and some physical science teachers. It did not appear to focus intensively on improved pedagogy, a vision of the classroom, or on overall curriculum reform in science education. There was limited focus on assessment as it relates to schools.

Some observers were concerned that the link to the classroom was not strong enough and doubted whether the substantial curricular issues inherent in offering such Institutes were adequately addressed by Institute staff and/or participating teachers.

There was some confusion on the part of some Summer Institute staff about their vision for a science classroom. For example, support for the pedagogical concept of "less is more" was often mentioned at the same time that there was a stress on covering more material in the curriculum.

On the other hand, some observers saw significant attention to classroom issues in at least four of the sites. One site visitor wrote:

> There was clearly a vision of the classroom as one where students are active, hands-on/minds-on learners and where learning is interdisciplinary in nature, where many aspects of science come together.

**Component 3 — Teacher Development Program Activities**

*This section of the template examines how teachers are helped to develop new strategies, skills, and knowledge. It includes examination of appropriateness of activities for adult learners, immersion in the scientific process, and inclusion of the use of tools and methods of scientists. Important elements include strategies that are transferable to the classroom, collaborative and cooperative learning, and the idea that teachers should be able "to plan for use of new knowledge and skills in their own classrooms with their own curriculum."*

While every Summer Institute allowed a certain amount of these types of activities to take place, at least 10 of the 15 used substantial amounts of time for lectures and other large group presentations with limited input, problem solving opportunities or debate on the part of the teachers. Several observers noted the lack of opportunities for practice teaching with peer or instructor feedback. However, some field experiences were extremely interactive, encouraged problem solving, and allowed for excellent interchange between teachers and scientists.

The comments of two site visitors give examples of their observations concerning this component:

> The process of investigation as a way of building scientific knowledge is under emphasized and often the field activities that teachers engage in (meant for them to adapt for their students) view science as a body of knowledge to be learned, a set of rules to apply. This is observed in teachers' lesson plans and demonstrations. Students learn vocabulary first (abstract) before investigating or experimenting (concrete); there is emphasis on labeling or naming; there are more answers than questions; the big ideas or concepts are lost in the focus on facts.

> Participants were surprised by the interdisciplinary nature of science investigations, and noted their concerns with their own discipline-bound approaches in the schools. This richness of resources, however, also became a weak point. Many participants noted that the Institute

> attempted to cover too much. They recommended that selected scientists, who could effectively model science teaching as it should be practiced and taught, participate in the future and that options be provided so that participants might select certain areas for more in-depth study. Moreover, they wanted more opportunities to process the information given to them by the scientists, and wanted to shadow some scientists in their Labs to better see how science is really carried out.

The incongruity between instructional format and design of the Summer Institutes and the larger issue of reform of science education on the elementary, middle/junior high and high school levels was noted by every site visitor at virtually every one of the programs. Some of this was due to the planners' limited experience with reform of science education on elementary/secondary levels and some to the limitations implicit in any Summer Institute which cannot do everything for all people at once.

### Component 4 — Uniqueness of the DOE Laboratories and Other Federal Facilities

*This section is designed to capture how the Institutes take advantage of unique laboratory resources and missions, including scientists and technicians with whom teachers might be able to interact directly and who would serve as role models.*

The ***"Intended"*** columns of the completed templates reveal that program staff at many sites anticipated that scientists and technicians would participate in program design, the development of the scientific/technical content, and collaborate with teachers to solve real or simulated problems using the equipment of the Labs and facilities.

Institute staff in several locations commented that the limited pre-program time made lengthy collaboration with scientists and technicians difficult in the planning process. In view of that, many of the sites did well to involve the number of scientists they did. Site visits indicated that a range of three to eleven scientists were involved in each Institute. Establishing activities that the teachers could learn from and also understand was not an easy task at all the sites. That it was achieved to a modest or even notable degree at many of the sites was a substantial success.

#### *Role models in science and mathematics*

The issue of role models was not one that all the Labs could do anything about in the short term. Women and minorities were generally present in low numbers at the Labs and other sites. In addition, many individuals were simply not available to work with participating teachers on short notice. There were, however, strong exceptions to this generalization and the Labs could certainly do more in subsequent years to further the goal of greater diversity in role models.

Summer Institutes that offered a variety of interactive projects for teachers provided a substantial degree of choice to participants. These sites also provided for a degree of dialogue between participants working on different research projects. At least three Summer Institutes had as many as seven or eight different investigations in which teams of teachers participated with a mentor. In some, the teachers were fully engaged, actually working on a meaningful research project. In others, the teachers had to be more or less observers.

The contributions of the scientists were significant and their responses to the participants make a major case for the use of these federal facilities in the future. One group of scientists, when asked if they would encourage such an Institute next summer, responded:

> *"expand the project." "Do it again." "It isn't too great a demand to make on us as scientists."*

Particularly valuable relationships developed between teachers and scientists/technicians in those Institutes where an individual served as a strong liaison between the Institute staff and the scientific community.

### *Content-rich environments*

The uniqueness of the laboratory environments as a place for professional development of teachers explains some of the intensely content rich aspects of the Institute. Each of the sites had resources, both human and physical, which were astounding to most of the teacher participants.

Striking a balance between the access to content knowledge and the application of frontier science to instructional change and curriculum improvement in schools is a massive undertaking. The problem of helping the instructional staff at these Institutes to be aware of new developments in and approaches to classroom instruction of students is a serious long-term issue and not one that can be coped with in a few short preliminary "staff meetings" prior to a single Summer Institute.

## Component 5 — Follow-Up

*The follow-up component of the template focuses on encouraging and reinforcing the use of new knowledge and skills in the participating teachers' classrooms.*

Plans for follow-up and early activities were noted by the NCISE study observers during their initial Institute visits. Details on these and the actual extended follow-up are found in Part II of this report.

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## Component 6 — Teacher Leadership and Responsibility

*This section of the template involves looking at the different ways teachers could share responsibility for aspects of the Institute's program, such as development, delivery, and implementation and explores the degree to which teachers could have input into decisions about the content, process, implementation and evaluation of their learning experiences. This section of the template also includes examination of teachers' roles as leaders in their schools after their Institute experiences, as well as the long-term commitment and support from the laboratory to their schools and communities.*

Once again, the limited time for planning made involvement of teacher participants prior to the start of the Institutes difficult. Most observers did not report significant attention to teacher leadership through the course of the Institute. Several Institutes did have small groups of teachers involved in the planning process (one to three teachers). At least two Institutes involved small groups of teachers in limited preliminary planning.

Many teachers felt a responsibility to share the ideas they had been exposed to. That is, they indicated a level of personal responsibility for conducting in-service at their own school sites. Reported in the words of one site visitor:

> Teachers did not feel that they took on leadership responsibilities during the Institute and, in fact, felt somewhat helpless to influence the course of events. On the other hand, teachers felt they had the responsibility for spreading their learnings back home once the Institute was over; they planned variously to do in-services, have demonstration classrooms, and present their learnings to others.

Several site visitors pointed to opportunities that appeared to be available for teachers to exercise additional responsibility during the follow-up process, but this could not be substantiated at the date of the summer visits. Again, this depends on the organization of the schools themselves and the degree to which teachers are allowed or encouraged to assume responsibility. Another site visitor wrote:

> Teachers were consulted throughout the Institute about how it was progressing and they were given opportunities to be leaders within their teams or sub-groups. It is difficult to judge how well this will translate to a school setting without greater support for leadership within the school itself. Teachers expressed a readiness to continue in their contacts with others/peers about science in the future.

Most Institutes allowed time for the preparation of plans for later in-service work by teachers. However, site visitors noted this was often done without the feeling that the teachers had clear administrative support or a firm knowledge of how or when the actual in-service could be scheduled.

In large measure, this important component of the template cannot be fully tested without additional evaluation of participants in the first year and further attention to this topic in subsequent years of Summer Institutes run by these federal Laboratories and other facilities.

**Component 7 — Program Evaluation**

*This section focuses on monitoring participant satisfaction during the program, on-going adaptation, and both formative and summative evaluation processes of the Summer Institute staff during the general time frame of the Summer Institute.*

In general, the Summer Institutes gathered data from participants and carefully reviewed the needs of teachers throughout the duration of the Institutes. Teachers at several sites commented that modifications were made based upon the evaluation process. Journals were used as an interactive tool in at least four of the Summer Institutes, with ideas being shared among participants and with program leaders.

Short questionnaires were also used at several sites on a daily or twice-weekly basis to gain information and feedback about presenters and the degrees to which a portion of the program met overall goals. Given the complexity of scheduling and the variety of presenters that had been arranged at many of the Institutes, the program staffs appear to have done a remarkable job in making modifications in these first-year sessions.

## FINDINGS USING THE PRE- AND POST-SURVEY

Following is a summary of the findings related to participant expectations, level of satisfaction and comfort level with subject matter, and instructional techniques.[2] There were 328 responses in the Pre-Survey and 338 in the Post-Survey.

### Expectations

Question #6 in the Pre-Survey (Figure 3) and question #3 in the Post-Survey (Figure 4) were compared to obtain information regarding the participants' expectations as compared to their actual experiences. On a scale of 1-3 the mean distribution ranged from 2.7-2.9, indicating participants had uniformly high expectations with regards to learning content, laboratory skills, applications, pedagogy, and activities that could be transferred to their own classroom setting. For the most part their expectations were met; the lowest score (3.3) referred to their having learned laboratory skills that they could teach their students.

**Figure 3**

**Pre-Survey #6 — Indicate your expectations in regard to the program (either during the program or as a result of your participation).**

| | | Expectations (Pre) Summary of Responses (Figures in Columns 1-3 are in Percentages) | | | | |
|---|---|---|---|---|---|---|
| | | 1 I do not expect this will occur | 2 I am not sure this will occur | 3 I expect this will occur | Mean | SD |
| a. | observe scientific research in the laboratory | 4.8 | 16.6 | 78.6 | 2.7 | .54 |
| b. | increase my science/mathematics/technology content knowledge | 1.0 | 7.2 | 91.8 | 2.9 | .32 |
| c. | increase my knowledge of applications in science/mathematics | 1.0 | 7.3 | 91.7 | 2.9 | .32 |
| d. | gain new perspectives on how science/mathematics/ technology should best be taught | 1.7 | 10.8 | 87.5 | 2.9 | .40 |
| e. | learn about activities I can use in my classroom | 0.7 | 10.0 | 89.3 | 2.9 | .34 |
| f. | develop activities I can use in my classroom | 0.7 | 13.4 | 85.9 | 2.8 | .38 |
| g. | learn about how to use specific equipment and technologies in my classroom | 2.1 | 20.4 | 77.5 | 2.7 | .47 |
| h. | learn laboratory skills that I can teach to my students | 4.2 | 20.1 | 75.7 | 2.7 | .54 |

[2]Total responses reflect input from ten out of fifteen Labs/facilities: two Labs did not submit post surveys, one Lab did not submit any pre or post survey results, one Lab misinterpreted questions and one Lab did not submit pre-survey results.

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Figure 4

**Post-Survey #3 — Indicate the extent to which you agree with each of the following statements about what occurred during your participation in the program.**

| | | What Learned (Post) Summary of Responses (Figures in Columns 1-4 are in Percentages) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 Not at all | | | 4 To a great extent | Mean | SD |
| a. | I increased my science/mathematics/technology content knowledge | 0 | 8.8 | 32.0 | 59.2 | 3.5 | .65 |
| b. | I increased my knowledge of applications in science/mathematics | 0 | 3.8 | 32.6 | 63.6 | 3.6 | .56 |
| c. | I gained new perspectives on how science/ mathematics/technology should be best taught | 0.6 | 4.7 | 26.9 | 67.8 | 3.6 | .60 |
| d. | I learned about activities I can use in my classroom | 0 | 4.2 | 22.2 | 73.6 | 3.7 | .55 |
| e. | I learned laboratory skills that I can teach to my students | 2.7 | 13.3 | 31.4 | 52.6 | 3.3 | .81 |

## Level of Satisfaction

Participants rated their level of satisfaction with the program by completing question #4 on the Post-Survey (Figure 5). On a scale of 1-5, the mean ranged from 3.9 to 4.6 with advance communication receiving the 3.9 and orientation 4.0. This reflects back to the lateness of award notification to the programs. Overall, the average mean was 4.33 indicating a level of satisfaction of very good.

**Figure 5**

**Post-Survey #4 — Rate the following aspects of the program.**

**(Figures in Columns 1-5 are in Percentages)**

| | | 1 Poor | 2 Fair | 3 Good | 4 Very Good | 5 Excellent | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| a. | Program administration | 0.9 | 3.3 | 14.0 | 35.8 | 46.0 | 4.2 | .87 |
| b. | Advance communication | 3.3 | 9.5 | 18.8 | 29.4 | 39.0 | 3.9 | 1.12 |
| c. | Orientation | 0.9 | 7.2 | 18.6 | 38.0 | 35.3 | 4.0 | .95 |
| d. | Availability of resources | 0 | 3.0 | 11.9 | 33.9 | 51.2 | 4.3 | .80 |
| e. | Assistance provided by program staff | 0 | 0.6 | 4.4 | 27.7 | 67.3 | 4.6 | .58 |
| f. | Workshop leaders | 0.3 | 0.9 | 7.6 | 34.7 | 56.5 | 4.5 | .70 |
| g. | Interactions with other teachers | 0.3 | 1.2 | 8.0 | 24.9 | 64.7 | 4.5 | .73 |
| h. | Interactions with scientists/technicians | 0.3 | 1.8 | 10.4 | 30.1 | 57.4 | 4.4 | .77 |
| i. | Receiving advice and support for sharing experience | 0.6 | 1.8 | 9.3 | 32.3 | 56.0 | 4.4 | .78 |
| j. | Receiving support for extending experience to the classroom | 0.3 | 1.8 | 9.0 | 29.7 | 59.2 | 4.5 | .76 |

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## Comfort Level

Comparisons of participants comfort level with content and transfer to the classroom were obtained by their responses to question #5 on the Pre-Survey and to question #6 on the Post-Survey (see Figure 6). On the Pre-Survey respondents indicated they had a fairly good comfort level with their level of knowledge and ability to transfer to the classroom and in the Post-Survey as well. Although there were no statistically significant differences, there was a slight change towards greater comfort with the greatest changes noted in their increased confidence in their ability to inform their students of various science/mathematics and technology career opportunities and their current level of science, mathematics and technology knowledge.

| **Figure 6**<br>**Pre-Survey #5 and Post-Survey #6 — Indicate the degree to which you agree or disagree with each of the following statements.** | | **Figure 6**<br>**Figures in Columns 1-4 are in Percentages**<br>**Comfort Level (Pre) — Summary of Responses (Shaded)**<br>**Comfort Level (Post) — Summary of Responses (Unshaded)** | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1 Strongly Agree** | **2 Agree** | **3 Disagree** | **4 Strongly Disagree** | **Mean** | **SD** |
| a. | I am comfortable with my current level of science/mathematics/technology knowledge | 12.9 | 45.8 | 32.0 | 9.3 | 2.4 | .82 |
| | | 19.2 | 52.0 | 23.1 | 5.7 | 2.1 | .79 |
| b. | I feel comfortable teaching science/mathematics/technology | 35.0 | 51.1 | 10.2 | 3.7 | 1.8 | .76 |
| | | 45.2 | 47.0 | 5.1 | 2.7 | 1.6 | .70 |
| c. | I feel comfortable managing a class of students who are doing hands-on activities | 49.4 | 42.3 | 5.6 | 2.7 | 1.6 | .72 |
| | | 62.7 | 32.5 | 2.4 | 2.4 | 1.4 | .66 |
| d. | I feel comfortable demonstrating science/mathematics/technology principles to my students | 40.3 | 51.0 | 5.6 | 3.1 | 1.7 | .71 |
| | | 56.9 | 36.4 | 4.8 | 1.9 | 1.5 | .67 |
| e. | I feel confident in my ability to discuss science/mathematics/technology applications with my students | 35.0 | 48.6 | 13.9 | 2.5 | 1.8 | .75 |
| | | 44.3 | 47.3 | 6.0 | 2.4 | 1.7 | .70 |
| f. | I feel confident in my ability to inform my students of various science/mathematics/ technology career opportunities | 23.4 | 50.8 | 21.8 | 4.0 | 2.1 | .78 |
| | | 35.3 | 51.8 | 10.2 | 2.7 | 1.8 | .72 |
| g. | I feel confident in my ability to help my students answer their own questions | 33.3 | 55.5 | 9.3 | 1.9 | 1.8 | .68 |
| | | 45.9 | 47.4 | 4.5 | 2.2 | 1.6 | .67 |
| h. | I feel confident in my ability to supervise my students' research projects | 30.4 | 52.8 | 14.3 | 2.5 | 1.9 | .73 |
| | | 46.1 | 43.4 | 8.0 | 2.5 | 1.7 | .73 |

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Overall, the Institutes received substantial credit and applause from participants. A participant from Washington, DC may have summed up a substantial number of opinions by saying that one Summer Institute was designed for, "any teacher who was willing to open the door and go through it."

## SUMMARY OF FINDINGS

Overall NCISE site visitors found the Institutes to be of very high quality. These 15 Summer Institutes began a valuable process of exploring effective interactions between teachers and diverse federal facilities, all with research missions. During the four week programs, staff members were coping with modifications and improvements on an almost daily basis at most of the Institutes.

Of the 15 projects, only one ran a program that they had offered several times before, with the same materials, time line, and overall structure. It is interesting to note that this Institute received praise as a coherent, teacher-centered program with significant science input, while also offering reflective time for groups and individuals to process the experience.

One commonality that affected all the Institutes was the lateness of grant announcements, which made the recruiting process difficult because it was so foreshortened. This reduced the pool of available applicants and caused some of the projects to run with an enrollment under their authorized 50 participants. In general, the recruitment process did not allow for any selection of teachers. Virtually all who applied were accepted with many being notified late in the spring. An unknown number of teachers who were accepted had to decline because of late notification. Survey data indicated that advance communication, prior to the start of the Institutes, could be improved.

Teachers appreciated the respect they experienced from scientists and staff and exposure to science, mathematics and technology professionals, and sites and equipment they had never encountered before. This level of exposure alone could have valuable long-term consequences for teacher motivation and interest, as well as knowledge base.

Assuming funding in subsequent years, ways to strengthen both programmatic and pedagogical elements were identified by both the Summer Institutes staff and NCISE site visitors. These are reflected in the recommendations found in Part III of this report.

## PARTICIPANTS COMMENDATIONS IN REGARD TO 1993 SUMMER INSTITUTES

Teacher participants indicated the following commendable activities in regard to their experiences in the Summer Institutes:

- Expressed a great deal of enthusiasm for the Summer Institutes. Terms such as "invigorated, renewed, and validated" as a result of their experiences were heard many times.
- Felt the high level of demand made on participants was uplifting and rewarding to them.
- Praised the Institutes for their immediate response to teacher suggestions resulting in program adjustments and logistical changes.
- Lauded the Institutes for their excellent organization. Attention to administrative details meant program considerations could take precedence.
- Indicated they had a better understanding of the relationship of science to real world applications and had exposure to state of the art scientific developments.
- Felt the Institutes provided them the opportunity to have personal interaction with and acknowledgement by scientists as well as providing opportunities for them to interact and exchange among themselves in a learning environment.
- Expressed that the Institutes provided them the exposure and opportunities to learn together with teachers from different geographic areas and cultural backgrounds.
- Obtained an increased awareness of local resources and increased confidence in doing "hands on" science as a result of their Institute experience.
- Were reassured by the promise of follow-up provided to them.

# PART II — EVALUATION OF 1993 SUMMER INSTITUTES FOLLOW-UP ACTIVITIES

## BACKGROUND

The 15 Summer Institutes proposed specific follow-up procedures at the time the 1993 proposals were written with most activities to take place during the 1993-1994 school year. Geographic distances between participants' schools figured in the follow-up plans of nearly every 1993 Summer Institute site. The time and the cost involved in bringing people together for one or more follow-up sessions are considerable even for those 1993 Summer Institutes that recruited largely from their own states.

Every Institute obtained signed agreements to allow teachers to participate in follow-up session(s) and administrators were to be included in follow-up sessions by at least four Institutes sites. During the year, all of the 1993 Summer Institutes carried out some form of follow-up. This part of the report examines what these follow-up efforts were and how they were carried out.

Many possible varieties of follow-up were noted, including additional training, on-site or telephone consultation, networking through newsletters or telecommunications, and the further training of local resource teachers or others who might provide on-going assistance to classrooms.

Virtually all of the proposed activities called for *group meetings* of the participants on one or more occasions in the school year following the Institutes. For Institutes that planned to bring the group of participating teachers together, these meetings were usually between November 1993 and March 1994.

All of the proposals anticipated the *production of follow-up print media*, either as material coming from teachers themselves or from the various projects. One site planned to edit and publish teacher-written activities and circulate this document to all participants. Three other Institutes developed handbooks to further support teachers in their classrooms. These handbooks ranged from curriculum and activity outlines to resource lists of people and institutions.

Thirteen of the proposals discussed the anticipated use of *telecommunications* as a means to link teacher-to-teacher and to tie back to the Lab as a resource. At least three sites planned to loan equipment to schools, arranging for delivery and some additional support services.

## DATA COLLECTION AND EVALUATION PROCESS

During spring and summer 1994, NCISE collected data in several ways about follow-up efforts. These included:

- Site visits to eight projects during scheduled follow-up sessions (see Appendix G). (Only eight of the fifteen projects had follow-up events scheduled during the period of the follow-up study.) Site visitors conducted formal interviews with teachers and staff, and observed program elements; they also discussed and observed other follow-up events and services. Several quotations from these reports appear in the following pages, as part of the documentation of follow-up activities (see Appendix H and I for site visitor guidelines and sample follow-up questions).

- Phone interviews with directors at all 15 sites during which they were encouraged to discuss actual follow-up services, along with their assessment of the effect of follow-up. Many discussed problems they had encountered and their plans for future improvement.

- Phone interviews with participants, usually reached at their homes, during which a similar series of questions were asked to ascertain their level of involvement in follow-up and its utility to each of them. In these interviews, participants' responses included anecdotal comments in regard to their own involvement in specific Institutes. Although an effort was made to reach a randomly selected group of 100 participants, only 63 could be successfully contacted.

A summary of data collection activities appears in Figure 7.

**Figure 7. Data Collection for Follow-up**

| Site visits | Institute Director Interviews | Teacher Interviews |
|---|---|---|
| Eight sites | All 15 sites | 63 teachers<br>from all 15 sites |

Information from all of these data sources is drawn together in this narrative report, examining the impact of follow-up efforts after the 1993 Summer Institutes. By the time of the interviews for this follow-up study, virtually all of the proposed activities for 1993 participants had been completed. However, several Institutes indicated that they would continue to communicate with past participants, at least on the level of newsletters and releases of upcoming program information.

### Limitations

The data collection efforts netted information about elements of the follow-up at each site. Strict comparison of all the sites is not possible for every element of their follow-up programs, because of the diversity of the follow-up at the various sites. In many cases, the follow-up activities were limited in scope or served only a small percentage of the teachers originally enrolled in the program.

Another consideration in examining follow-up from the 1993 Institutes is the degree to which staff changes at the DOE Labs and other federal sites may have affected follow-up. At four of the sites, follow-up was conducted largely by individuals who had not been involved in the original Institutes.

## FINDINGS REGARDING THE TYPES OF FOLLOW-UP

Follow-up took many forms such as main events scheduled by Institutes, telecommunications, sharing of equipment and personal follow-up such as phone calls and site visits.

### Main Events

Each project scheduled a "main event" at some time during the year. This was a gathering to which some or all of the participants were invited. Two projects had a very high rate of involvement in these events, but the average level of participation across all projects was approximately 45% of those invited (this includes the noted high attendance at two projects). In teacher interviews, estimates of participation in these main event follow-up sessions were generally lower than the estimates provided by project directors. This may have been because the directors were reporting levels of attendance related to people who had said they would attend, not the full number of Summer Institute enrollees.

The actual pedagogy of the "main follow-up events" differed a great deal from site to site ranging from no correlation to classroom practice to discussion of classroom applications and site visits to participants' classrooms. Teachers expressed appreciation of the follow-up effort, but they also reported little direct involvement with the process. Three sites that were visited by NCISE staff highlighted teacher participant presentations at follow-up sessions, but only one had a session planned by a teacher participant. Of this session, a site visitor reported:

> Rather than starting with a lecture, the teacher leading this session gave a brief set of instructions so they could get on the university computer network and then encouraged her colleagues to "discover." She also gave them a technique to use when they needed help that they could, in turn, use in their own classrooms as a management technique. Thus, the entire morning proved to be an effective model of how teachers could get started in their own classrooms. The other teachers received the session enthusiastically.

A number of sites used expert presenters for follow-up on specific topics. In many of these cases, the experts were scientists well-versed in their own fields, but with no experience in schools. Teachers who attended these sessions reported that there was little dialogue, and it was not clear what aspects of the presentation they could use in schools.

### Telecommunications

Telecommunication using e-mail and modems was mentioned, at least as an option, in all original proposals. Reports from directors and participants indicates that this happened sporadically and only in some follow-up efforts. One Institute follow-up had ten participants linked by the Internet, a success rate of 22% for that project, and at least one site held an entire half-day follow-up session on telecommunications for educators.

Information about e-mail, from teachers and others, suggests that many of the roadblocks occur at the school level. Equipment is not in place in many schools, or it is non-functional. The largest single issue beyond computer-software-modem concerns is the availability of dedicated phone lines. Many schools seem unwilling/unable to provide these connections even when the hardware and software problems are solved. A site visitor accompanying an Institute director and a senior scientist on a school visit reported:

> They also wanted to find out what resources the teacher had access to, specifically if she had a computer, modem, and phone line so that she could tap into the Lab's telecommunications network. When they learned she did not have a modem or phone line, they tried to persuade the principal to provide the teacher with these resources and suggested methods for paying for them.

In the latter example, the substantial costs of training the teacher and dedicating a portion of the Lab's computer network to services to schools ran afoul of a school system that would not or could not complete its share of the bargain, agreed to when the teacher signed up for the Institute. However, other teachers mentioned that they knew that their school districts had signed letters of support for those participating in the Summer Institutes. They indicated they had used this fact to urge administrations to provide additional equipment, communications services, and other functions.

### Sharing of Equipment

A further aspect of follow-up was the sharing of equipment on a loan basis or the gift of equipment to schools.

Computers were transferred from at least seven Labs in this process to benefit teachers who had participated in the Summer Institutes. Laboratory equipment was provided by at least three Labs.

The most active loan programs included transportation of equipment. At least one Institute actively staffed the loan program, as reported in this site visitor's words:

> The Institute saw its role with the teachers as a continuing one. Those teachers who participated in the summer of 1993 will be able to continue to borrow the equipment in the 1994-95 school year, provided that they take a brief in-service workshop reviewing the proper use of the equipment. To help teachers to use the equipment, the Institute gave the responsibility for distributing and monitoring the equipment to one staff member who was always available (when not transporting the equipment) to answer questions about its use. Almost all the teachers said they had called him and found his answers helpful and effective.

In five of the 15 sites teachers reported difficulty operating loaned equipment.

**Personal Follow-up**

Another follow-up strategy used by the Summer Institutes, but mentioned only rarely in original proposals, consisted of informal telephone calls from Institute staff to teachers. Several projects indicated that they called participants (about scheduling or to check on progress). Project directors could not quantify the response rate precisely, but one indicated that they had reached "well over half" of the participants. However, in a number of cases, involving at least 11 of the sites, some teachers reported being contacted by phone as part of the follow-up effort while others (at the same site) reported no contact. Of participants interviewed by phone, 38% indicated that they participated in no face-to-face follow-up.

Classroom or school visits were also employed by Lab staff to observe and support participating teachers. In some instances the visitors also met with the school principal. The visits were an opportunity for Institute staff to see what needs individual teachers had that they could assist with, assess how the teacher was incorporating the material learned over the summer, pass on information from other teachers, and keep the connection between the teachers and the Institute active. Some teachers described these visits as reinvigorating.

Just as the Institutes themselves often delivered knowledge with limited attention to instructional techniques, it appeared from interviews that a significant majority of the face-to-face follow-up sessions were also content-rich but limited in pedagogy.

Some teachers were able to bring their classes to the Lab site that offered their Summer Institute. Those who did were enthusiastic about the value of the trip and support of Lab staff.

## FINDINGS REGARDING PLANNING OF FOLLOW-UP

Where teachers played an active role in the planning of the follow-up process, there was a general enthusiasm for the activities. Although it was impossible for interviewers to ascertain this from all sites, it appears that at least six of the 15 sites directly involved teachers in planning follow-up sessions in situations where groups of teachers gathered for a full day or half-day.

Overall, there were dramatic differences in the degree to which teachers were involved in the planning and interactions around the follow-up process. Examples drawn from two different site visits serve to highlight this. A site visitor who watched one follow-up event and who had a chance to talk to several teachers in the session commented:

> A major weakness in the follow-up activities is the dependence on scientists who may or may not have well developed teaching skills. The observed workshop consisted of a lecture about the nature of minerals and rocks and an overview of the materials in a packet of geology materials for classroom instruction that the teachers were to pilot. The geologist making the presentation admitted that he did not know much about teaching children and was unable to develop many teaching activities. Although participants did have an opportunity to ask questions, there was little opportunity for them to discuss how to present geology to students in general or how to use the packet of materials specifically.

In contrast to this assessment of a follow-up session that had little immediate value to teachers, another site visitor reported on follow-up at an Institute site in which agricultural extension agents had been called upon to support teachers in the field:

> The initial organization of the Summer Institute supported the implementation of its teachings. Creating teams of teachers with an extension agent built in self-perpetuating follow-up support. The center did not have to monitor and guide the teams, as they were truly independent. Having the team create a plan before they left the Institute gave the teachers something specific to work for during the year. Certainly, not all plans developed the way the teachers had anticipated, but at least they had something to build upon. The extension agents helped the teachers make needed contacts and supplied technical advice....

## ADDITIONAL FINDINGS

- Teachers from four of the 15 sites reported interactions between their Summer Institute and NSF funded "statewide systemic improvement" projects.

- Teachers from at least nine of the 15 sites reported informal contact among participants during the following school year (beyond any Lab-initiated follow-up).

- In four cases teachers reported unequal access to follow-up services. In some cases this was due to geography, where great distances made it difficult to have site visits.

- Some sites tied follow-up activities to the stipend and others did not. Thus, some teachers chose not to participate in follow-up for which they felt they were not compensated.

- Many teachers seemed to feel that follow-up did not carry the importance of the initial Summer Institute. This was due in part to the limited nature of follow-up and also due to the fact that extensive follow-up was not available to everyone, due to geography.

- Some sites planned for on-going teams to work together in the schools. Interviewees suggested that this did not happen in any significant way. The teams did not have a place in the structure of the schools or school districts or did not have adequate time to meet.

In various forms, school system roadblocks were reported by a significant number of Institute directors and in teacher telephone interviews. Several teachers in a follow-up session at another Institute reported that they:

> "...felt hostility from their administrators toward the type of activities they learned at the Institute."

One of these teachers noted that:

> "...his principal did not want the students doing hands-on activities, but learning the 'scientific method'."

Such confusion about instructional practice on the part of a school administrator can confound the efforts of able teachers and the best professional development Institutes.

## SUMMARY OF FINDINGS

Overall, interviewers noticed a sense of interest and collegiality among many teachers who participated in this study. They were pleased to talk about the Summer Institute experience and follow-up, even in cases where they had little or no contact with the Lab site after the Institute. All participants interviewed indicated that they had been invited to participate in some form of follow-up interaction.

Just as the original Institutes differed in their content, process, and instructional techniques, the follow-up initiatives varied greatly. While the telephone interviews and site visits attempted to develop a unified view of the follow-up process, there was great variation in the specific events of each follow-up effort.

Telephone interviews indicated there was a general sense that follow-up sessions addressed certain aspects of actual classroom implementation that had not been explored in the Summer Institutes themselves.

Additionally, data gathered through telephone interviews and site visits showed that participants talked and shared informally with one another. These interactions may not have developed specific classroom applications, but they provided a rich source of ideas and inspiration, with teachers learning from each others' experiences. Many teachers felt isolated in their schools, and these informal networks and follow-up sessions helped them make professional connections.

Teachers who attended Institutes that incorporated follow-up as an integral part of their complete program tended to be more active in incorporating material learned during the summer than those teachers who attended Institutes that did not place a strong emphasis on follow-up. In four of the site visits, and in 15% of all the teacher telephone interviews, participants identified the significance of the follow-up process and the enthusiasm it generated.

Few follow-up sessions afforded hands-on opportunities or other events that might be defined as inquiry or constructivist learning. However, those participating teachers who experienced hands-on learning opportunities found them to be most useful. Generally, these were activities that were challenging to the adults and usable in many classroom situations.

Follow-up raises important geographic questions, among them the service area of the individual project. Institutes that drew from a national or multi-state pool of teachers had fewer options in conducting follow-up than those programs serving the immediate region. One Summer Institute gave preferential follow-up treatment to in-state teachers, essentially as if the funding were state-specific although attendees came from several states. Other Institutes recruited only within their states at the beginning of the process. While there is an argument that serving teachers on a local/regional basis encourages follow-up communication, there is also a need to use federal dollars and services equitably, making services available to teachers throughout the U.S.

# PART III — RECOMMENDATIONS

## PROGRAM ADMINISTRATION

- Continue the process begun in 1993, drawing upon the resources of federal Laboratories and other facilities to improve learning in American schools.

- Relate the funding cycle to the school year to allow for adequate recruiting, pre-program planning time, and decision-making time for teachers.

- Determine the audience for a given Institute and recruit participants based on the Institute's clearly established goals. *This step will also clarify pre-program communications.*

- Explore *multi-year* contracts, allowing a Lab to engage in on-going professional development including follow-up and other forms of support which the Lab could plan for and carry out over a longer period.

- Design the participant selection process to ensure selection of teachers with leadership abilities and skills who can transfer their experiences in the Summer Institutes to their educational system.

- Examine the benefits and drawbacks of drawing teacher participants with the same knowledge base or grouping them at times during the Institute according to knowledge level.

- Consider recruiting *teams* from schools or school districts, such that the members could support one another upon return to the classroom and could better develop effective in-service opportunities for their peers.

- Increase diversity (both gender and ethnic) of participants and presenters, bringing both role models and potential mentors to the fore.

- Recruit teams of participants from broader geographic areas.

- Explore cost-saving options to reduce the cost per teacher.

## PROMOTING A NEW VISION OF CLASSROOM TEACHING AND LEARNING

- Articulate and communicate to participants a vision of how learning and/or teaching of science can look in the classroom.

- Examine emerging national standards for teaching and learning and other reform documents to help communicate the new vision and connect it to other reform initiatives.

- Involve a team of teachers in planning an Institute and its follow-up. *These teachers should be chosen in part for their knowledge of and skill at instructional practice.*

- Work in advance with outside presenters to further their understanding of adult learners and common goals and methodologies, so there is consistency throughout the Institute.

- Encourage a greater understanding and clarity of vision among Lab education staff and scientists of new research and practice in science education and cognition. Help them model the effective practices they hope teachers will use with their students.

## TEACHER DEVELOPMENT PROGRAM ACTIVITIES

- Ensure that education staff working with participants model pedagogy reflecting the latest research on effective teaching.

- Ensure that the relationship between instructional format and design of the Summer Institutes and the larger issue of science and mathematics education reform be clearly defined.

- Arrange dialogue and visits between scientists and participating teachers, creating a stronger link between these two groups and encouraging better two-way communication. *This can be done both face-to-face and through telecommunications over an extended period.*

- Provide concrete experiences early in any inquiry, building opportunities for problem solving and developing meaning from experience. *This will model effective instructional approaches that encourage creativity and a spirit of cooperative inquiry among the teachers' students.*

- Decrease lecture time and increase actual investigation and immersion time during the Institutes. *This may necessitate smaller groups.*

- Focus on linking new knowledge being developed by participants to larger understanding of science.

- Fund several models of professional development for experimentation.

- Allow some choice by teachers of alternative experiences they may explore in conjunction with each Institute. *This should be guided by research and practice relating to adult development.*

- Consider formats other than a 20-day Summer Institute.

## UNIQUENESS OF THE DOE LABORATORIES AND OTHER FEDERAL FACILITIES

- Consider how to make specific science research skills possessed by the staff in the Labs and other federal facilities available to science and mathematics teachers across the nation on a continuing basis.

## FOLLOW-UP

- Focus the follow-up site visits on technical assistance for implementation. Sustaining knowledge and skills and helping teachers disseminate their learnings to their colleagues require a high level of on-going support throughout the year.

- Plan follow-up that becomes part of a longer-range process and ensures a relationship between the teachers and the Labs and other federal facilities offering the Institutes. *Rather than viewing the Institutes as a summer event with some type of check-in during the school year, educators should think of themselves as on-going participants, linked to scientific resources, but also sharing their own curricular expertise through a growing network of science education activists.*

- Obtain commitment to specific follow-up strategies early in the process from teachers and school administrators. *If this means release time for travel and meetings, that should be arranged. If these strategies require a modem and telephone line, along with an e-mail system, that too should be arranged in whatever fashion is necessary to encourage the full participation of the teacher.*

- Involve teachers in follow-up planning and execution. *For this to be successful, it would have to begin early in the schedule of each Summer Institute, perhaps with a core group of teachers.*

- Provide "hands-on" follow-up activities that could be easily transferred to the participating teachers' classrooms. Most teachers said that they found hands-on learning opportunities to be the most useful.

- Provide inclusive follow-up in all projects, so that no circumstance arises in which a teacher is left out of follow-up because of geographic, technological, or financial restrictions.

- Provide functional equipment to participants if distance learning techniques are to be used. *Many schools do not have the hardware, software, phone lines, and expertise to support telecommunication.*

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## TEACHER LEADERSHIP AND RESPONSIBILITY

- Increase the level of responsibility of all teachers in the planning and follow-up process.
- Allow time for teachers to practice new units of instruction and to obtain feedback within the Institutes.

## PROGRAM EVALUATION

- Continue soliciting data from teacher participants to modify present program administration, design, and delivery to best fit the participants' needs.
- Continue to obtain data from the Lab and federal facility staffs and use this information to modify the design and delivery of future programs.
- Pursue further evaluation to ascertain the changes in teachers' knowledge, attitude, and classroom practice as a result of their participation in the Summer Institute.

# Appendix A

## Projects and Sites Listed by Department or Agency

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# Sites and Projects Listed by Department or Agency

In order to emphasize the richness of resources and the variety of projects in which teachers engaged, we have reorganized the list of Summer Institutes here, breaking it down by federal agency and highlighting some of the topics investigated under the leadership of scientists and technicians at the site:

## Department of Energy

PACIFIC NORTHWEST LABORATORY, Richland, Washington
"National Teacher Institute in Materials Science and Technology"

SANDIA NATIONAL LABORATORY, Albuquerque, New Mexico
"GANAS" (Gaining Access to Natural Abilities in Science)

SANDIA NATIONAL LABORATORY, Livermore, California
"SUPER" (Science Understanding Promotes Environmental Responsibility)

ARGONNE NATIONAL LABORATORY, Argonne, Illinois
"FCCSET Summer Teacher Enhancement Institute"

SUPERCONDUCTING SUPERCOLLIDER LABORATORY, Dallas, Texas
"Summer Institute for Physics and Physical Science"

OAK RIDGE LABORATORY, Oak Ridge, Tennessee
"Restoring Our Waters Teacher Institute"

LAWRENCE BERKELEY LABORATORY, Berkeley, California
"Science and Society Teacher Institute"

CONTINUOUS ELECTRON BEAM ACCELERATOR FACILITY, Newport News, Virginia
"Summer Institute for Teacher Enhancement"

## Environmental Protection Agency

ENVIRONMENTAL PROTECTION AGENCY AND MIAMI UNIVERSITY, Cincinnati, Ohio
"Hands-On Environmental Science"

**Department of Commerce**

NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION LABORATORY, Boulder Colorado
"NOAA Summer Science Institute"

**National Aeronautics and Space Administration**

NASA JET PROPULSION LABORATORIES, Pasadena, California
"Teacher Enhancement Program"

NASA MARSHALL SPACE FLIGHT CENTER, Huntsville, Alabama
"Summer Teacher Enrichment Program"

**Smithsonian**

SMITHSONIAN INSTITUTION, Washington, D.C.
"Natural Science Institute for Teachers of Minority Students"

**Department of the Interior**

NATIONAL WETLANDS RESEARCH CENTER AND UNIVERSITY OF SOUTHWESTERN LOUISIANA, Lafayette, Louisiana
"Microscopy of the Wetlands"

**Department of Agriculture**

CLEMSON UNIVERSITY AND PEE DEE RESEARCH AND EDUCATION CENTER, Florence, South Carolina
"PEAK" Institute for Science in Agriculture"

# Appendix B

## FCCSET Summer Teacher Enhancement Institute Application Form

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# FCCSET Summer Teacher Enhancement Institutes

## Application Form

A. *Complete the following:*

1. Name of participating federal facility

2. Collaborative partners

3. Subject matter/theme of institute

4. Grade level (s) of participants

5. Number of participants

6. National or local participants

7. Commuting or residential institutes

8. Funding request

B. *In the space below, describe your institute.*

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# FCCSET Summer Institute Enhancement Institutes Application

*C. Briefly respond to the following questions:*

1. How does the institute take advantage of the resources unique to its federal facility?

2. How has the need for this institute been demonstrated?

3. What are the goals and objectives of the institute?

4. How are the goals and objectives of the institute linked to reform efforts (i.e., Statewide Systemic Initiative, National Council of Teachers of Mathematics Standards, etc.)?

5. How does this institute model demonstrate the best of research and practice?

6. What will participants be able to know as a result and practice?

7. How will equity issues be addressed, that is, both the need for the inclusion of underrepresented teachers or teachers representing students traditionally underrepresented, and for a climate which is supportive of females?

8. How will school systems support teachers participating in the institute?

## FCCSET Summer Teacher Enhancement Institutes Application

9. How will transfer of teacher learning from the institute to the classroom be ensured?

10. How will the institute build leadership skills of participants?

11. How will participants be selected?

12. What academic year follow-up activities are planned?

13. Will academic credit be available for participants?

14. How will the institute be evaluated?

*D. Budget:*

1. Develop a budget description, including all costs (stipends, staff, program development, etc.). Include all in-kind support.

# Appendix C

## Collecting Data on Summer Institutes Using the Template

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# C - 1

# Steps in Collecting Data Using the Template

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## Steps in Collecting Data Using the Template

**Spring 1993** FCCSET/DOE Summer Institute Training (Spring)

- Introduction to Template and its application to formative evaluation.
- Technical assistance in developing skills in completing "intended" column, ie. (describing their programs intentions.)

**Summer 1993** NCISE Conducts Site Visits

- Check accuracy of "intended" column.
- Complete "actual" column.
- Completion of individual site visit reports which include Template, commendations, issues, and recommendations.

**Fall 1993** FCCSET/DOE Conference

- Re-visit Profiling.

# C - 2

# A Tool for Profiling Teacher Development Programs

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# A TOOL FOR PROFILING TEACHER DEVELOPMENT PROGRAMS

**The National Center for Improving Science Education**

**with a Grant from**
**The United States Department of Energy**

**1993**

Purpose of Program Profiling

Significant investments of time, energy, and resources are currently being made in a wide variety of programs whose aim is to improve education. The Department of Energy is one of the investors, with the mission of improving student learning in mathematics, science, and engineering technology through the enhancement of teacher knowledge and skills. A wide variety of programs are currently being funded by DOE that target precollege education, providing unique learning opportunities for both students and teachers. How good are these programs? Is the funding being invested wisely? What adjustments could be made to better use the available resources and, as they shrink, where should the cuts be made?

In order to address these important impact questions, a prior question must be answered: what is actually happening in the programs? Without the answer to this question, it is impossible to know what it is that is causing either positive or negative learning outcomes. Likewise, it is impossible to know what to change for the purposes of improvement. The attached template was developed as a tool to help answer this question.

The template has an additional purpose as well. Instead of allowing only for description of a program, it also allows for comparison of that program to best practice. The template identifies what research and experience report to be "what works" - elements that, when part of a program's design, should enhance its effectiveness. Therefore, the template can also help answer another important question about a program: to what extent does it reflect best practice? Addressing this question helps program developers and managers identify components of their programs that could be the focus of improvement.

The template is thus a formative evaluation tool, as well as one of several assessment instruments needed to evaluate the impact of a program. It is the key tool used in the first phase of evaluation of Department of Energy precollege education programs - called Program Profiling - and one of several data collection tools used in the second phase - Summative Evaluation.

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Anatomy of a Template

The template provides a format for "profiling" a program as it reflects best practice. It is formatted in three columns. The first column lists Components of Effective Practice, as determined by its developers from research and experience. The components are concisely worded, as appropriate to this kind of a tool, and some may find they need clarification and/or elaboration. For this purpose, a set of operational definitions and a reference list are included with the template.

The second column provides the opportunity to describe the program as it is deigned to work, i.e., the Intended Program. The third column, then, is used to describe what actually happens when the program is functioning, the Actual Program.

Information from these columns can be used to address the following questions:

1. What is the best practice for these types of programs?

2. To what extent is the program designed to reflect what is most effective?

3. To what extent does the program in place reflect best practice?

4. To what extent is the program's design actually carried out?

5. Where are the gaps? What can be improved? What is beyond our control?

The last page of the template provides the opportunity to describe additional characteristics of the program and of its participants that may have an impact on its effectiveness. For example, certain program characteristics may work differently with different teachers (e.g., elementary vs. secondary), different school populations (e.g., urban vs rural), or different research foci of the sponsoring organization (e.g., theoretical vs hands-on).

Development of Templates

The templates for Department of Energy programs have been developed collaboratively, with the National Center for Improving Science Education playing a lead role, but with full participation from precollege education program managers and staff from DOE national Laboratories and other facilities. Early in the collaboration, it was determined that there was such a variety of programs that more than one template would be necessary to capture their important features. Several program "types" were identified in the first discussion - teacher research participation programs, student programs, systemic programs, and special programs - and it was decided that over the course of three years, a template would be developed for each.

Template development begins with searching and reading literature on each program type, focusing particularly on what research and practice indicate to be components necessary for such programs to be effective. During meetings of DOE and Lab staff, readings (mainly syntheses) selected by the National Center were discussed and components of effective practice identified through small group work. Center staff combined the work of groups into a draft template and circulated it for review.

Once drafted, the template was piloted as the primary tool for profiling DOE programs across the Labs. The template for Teacher Development Programs was the second template developed. Five Labs where such programs were being conducted were selected for the pilot study, using a set of criteria developed collaboratively. Center staff read descriptive material about each Lab's Teacher Development Program, and made two-day site visits during which program staff and teachers were interviewed and observed. A template was filled out as each Lab's "profile"; at the same time, refinements were made in the template.

Based on learnings from the pilot of how best to use the template to profile programs, the final draft of the template was then used by all Labs to profile their own Teacher Development Program. A summary of the profiles will be compiled by the National Center once that profiling is completed.

This same process will be used to develop, pilot, and then put to use the template for each program type.

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# FCCSET Teacher Development Template

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# TEACHER DEVELOPMENT PROGRAM TEMPLATE



**Program:**

**Completed by:**

**Date of Profile:**

| Components of Effective Practice | Intended | Actual |
|---|---|---|
| 1. Program Administration | | |
| a. Articulates clear program goals that are understood by all. | | |
| b. Is clearly assigned as the responsibility of one or more persons. | | |
| c. Includes teachers, scientists, educators, and administrators in program design. | | |
| d. Creates collegial atmosphere. | | |
| e. Ensures effective pre-program interaction. | | |
| f. Ensures effective program follow-up. | | |
| g. Communicates with and reports regularly to DOE. | | |
| h. Maintains database of participant information. | | |
| i. Establishes relationship with teacher's school/district. | | |
| j. Designs and conducts participant recruitment such that teachers representing and serving underserved populations are reached. | | |
| k. Other | | |

| Components of Effective Practice | Intended | Actual |
|---|---|---|
| 2. The vision for the <u>classroom</u> promoted by the program includes | | |
| a. a focus on deep understanding by students of major science concepts or principles, development of skills, and "scientific habits of mind" | | |
| b. a "hands-on, minds-on" instructional approach that includes investigation, discovery, and application | | |
| c. emphasis on depth (fewer concepts and skills) rather than breadth | | |
| d. balance between science content and process | | |
| e. ongoing, authentic assessment of important learning outcomes | | |
| f. materials, strategies, and perspectives sensitive to diverse cultures, languages, genders, and learning styles | | |
| g. other | | |
| 3. Teacher Development Program Activities | | |
| a. are appropriate for adult learners | | |
| b. model teaching principles and strategies that can be transferred to the classroom | | |
| c. are hands-on, allowing teachers to actively construct knowledge | | |

| Components of Effective Practice | Intended | Actual |
|---|---|---|
| d. include the use of tools, methods, and processes of scientists | | |
| e. immerse teacher in the scientific process | | |
| f. include actual or simulated problems or challenges or "real world" science | | |
| g. are designed so teachers learn cooperatively in small groups | | |
| h. include opportunities to practice new classroom behaviors or strategies | | |
| i. include opportunities for teachers to plan for use of new knowledge and skills in their own classrooms, with their own curriculum | | |
| j. include opportunities for teachers to work together as they learn and plan for transfer to their individual classrooms | | |
| k. other | | |
| 4. Uniqueness of the Laboratories | | |
| Activities take advantage of unique laboratory resources and mission, including: | | |
| a. scientists and technicians | | |
| • participate in program design, implementation, and evaluation | | |
| • assist in developing scientific/technical content | | |

| Components of Effective Practice | Intended | Actual |
|---|---|---|
| • collaborate with teachers to solve real/simulated problems | | |
| • serve as role models (minorities, women, disabled, senior/retired) | | |
| • scientific/technical facilities used for training, immersion, science experiences | | |
| b. the work being done (frontier science) both in the particular lab and in other DOE facilities, is the focus of teacher development activities. | | |
| c. other | | |
| 5. Follow-up | | |
| a. learning activities for teachers include follow-up, and are spread out over time | | |
| b. follow-up activities focus specifically on the use of new knowledge and skills in the classroom | | |
| c. teachers have the opportunity to try out new knowledge and skills in the classrooms before follow-up occurs | | |
| d. follow-up takes a variety of forms, including additional training, problem-solving or sharing meetings, on-site or telephone consultation, networking through newsletters or telecommunications, trainings and support of local resource teachers or others to provide on-going assistance. | | |
| e. other | | |

| Components of Effective Practice | Intended | Actual |
|---|---|---|
| 6. Teacher Leadership and Responsibility | | |
| a. teachers take on leadership responsibilities in aspects such as program development, delivery, implementation, follow-up, and spread to other colleagues. | | |
| b. Teachers have input and/or involvement in decisions about the content, process, implementation, and/or evaluation of their learning experiences. | | |
| c. Teachers are given support by the lab for leadership and networking activities such as sharing information, successful practice, and problems, either during the program or in follow-up. | | |
| d. There is long-term commitment and support -- including material, moral, logistical, technical, and symbolic -- from the laboratory, or as a result of arrangements made by the laboratory from the school or community. | | |
| e. other | | |
| 7. Program Evaluation | | |
| a. monitoring of participant satisfaction during the program and follow-up activities identified needed changes, which are made immediately, when appropriate and feasible. | | |

| Components of Effective Practice | Intended | Actual |
|---|---|---|
| b. ongoing formative and summative evaluation of important program outcomes involves data collection from a variety of sources, with resulting changes in program design. | | |
| c. other | | |
| **OPTIONAL:** **For programs that have a component that assigns participants to mentors for the purpose of involvement in research.** | | |
| 8. Teacher Assignments | | |
| a. done by individual(s) with science background | | |
| b. relate directly to the core competencies and ongoing work of the Lab | | |
| c. match backgrounds and research interests of the teacher | | |
| d. mentors are carefully selected to have time, interest, ability to talk to teachers at appropriate level | | |
| e. mentors are inducted into the role and supported throughout the experience | | |
| f. mentors are available or arrange for equally or more suitable substitute(s) | | |
| g. mentors are involved in a mentor/teacher ratio that allows daily interaction and support | | |

| Components of Effective Practice | Intended | Actual |
| --- | --- | --- |
| h. there is early correction of mismatches | | |
| 9. Preparation | | |
| a. teachers are oriented to their role and the Lab's working environment, and to the Department of Energy/Lab mission and competencies | | |
| b. teachers have clear expectations of what the experience will involve | | |
| c. mutual expectations are established in advance through mentor/teacher direct contact | | |
| d. mentors suggest readings and other pre-work accessible to teachers before arrival | | |
| e. facilities and working conditions required by teacher to do the assigned research are identified and are prepared in advance | | |
| f. teachers receive advance communication about housing and other logistics | | |
| 10. The Teacher's Research Experience | | |
| a. the research relates to the Lab's mission, unique capabilities, and core competencies, including<br>• applied and basic technologies<br>• integration activities<br>• product realization | | |
| b. is integral to, or a spin-off of, mentor's ongoing research | | |

| Components of Effective Practice | Intended | Actual |
|---|---|---|
| c. research has an unknown outcome, but the experience has a definable end point or output for the teacher | | |
| d. has been carefully designed for success with respect to teacher capabilities, time constraints, technology capability | | |
| e. includes elements of the research process, such as designing experiments, creating mathematical models, collecting, analyzing, and synthesizing data | | |
| f. incorporates the research process, with uncertainties, false starts, loose ends | | |
| g. involves technologies new to the teacher | | |
| h. involves the original literature | | |
| i. involves presentation of results to peers (scientists and teachers) | | |
| j. makes the teacher part of the research team, modeling the interdependence of team members | | |
| k. provides opportunities for updating their knowledge and skills | | |
| l. allows them to be treated as research colleagues | | |
| m. other | | |

# DESCRIPTIVE AND CONTEXT INFORMATION

## Program Characteristics

1. Stated Goals:

2. Program Developers *(names and roles)*:

3. Amount and distribution of contact time (e.g., two-week summer institute, three one-day follow-up sessions in October, December, February):

4. Nature of follow-up:

5. Program presenters *(e.g., Lab scientists, local teachers)*:

6. Scientific focus of Lab reflected in teacher development program (e.g., nuclear physics, stream ecology, nuclear medicine):

7. Special Lab facilities used in program:



## Characteristics of Target Population

1. Target is primarily

☐ individual teachers (how many? ________)
☐ whole school(s) (how many? ________)
☐ whole district(s) (how many? ________)
☐ other (*specify*: ______________________) (how many? ______)

2. Approximate percentage of participating teachers working in each location (1*):

______% rural
______% urban, but not inner city
______% urban, inner city
______% suburban

3. Average percentage of ethnic composition of schools of participating teachers (3*):

American Indian or Alaskan Native ________%
Asian or Pacific Islander ________%
Hispanic (regardless of race) ________%
Black (not of Hispanic origin) ________%
White (not of Hispanic origin) ________%

4. Approximate percentage at each school level (5*):

______% elementary
______% middle/junior high
______% high school

5. Approximate percentage teaching classes in (6*):

______% science
______% mathematics
______% technical/vocational
______% other (specify:________________________________)

*Numbers refer to item on "Background Information" survey completed before summer institute.

# Appendix D

## Schedule and Site Visitors

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# D - 1

# 1993 Summer Institute Schedules

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# 1993 SUMMER INSTITUTE SCHEDULES

| | |
|---|---|
| 13 June - 2 July | Clemson University and Pee Dee Research and Education Center, Florence, SC |
| 14 June - 9 July | Superconducting Supercollider Laboratory Dallas, TX |
| 14 June - 9 July | NASA Marshall Space Flight Center, Huntsville, AL |
| 14 June - 9 July | NOAA Laboratory, Boulder, CO |
| 25 June - 23 July | Oak Ridge Laboratory, Oak Ridge, TN |
| 27 June - 23 July | Continuous Electron Beam Accelerator Facility, Newport News, VA |
| 28 June - 23 July | Lawrence Berkeley Laboratory, Berkeley, CA |
| 6 July - 30 July | Smithsonian Institution, Washington, DC |
| 6 July - 30 July | Sandia National Laboratory, Livermore, CA |
| 6 July - 30 July | Environmental Protection Agency and Miami University, Cincinnati, OH |
| 11 July - 1 Aug | Pacific Northwest Laboratory, Richland, WA |
| 12 July - 6 Aug | NASA Jet Propulsion Laboratories, Pasadena, CA |
| 12 July - 6 Aug | NASA Marshall Space Flight Center, Huntsville, AL |
| 12 July - 6 Aug | National Wetlands Research Center and University of Southwestern Louisiana, Lafayette, LA |
| 19 July - 13 Aug | Sandia National Laboratory, Albuquerque, NM |
| 19 July - 13 Aug | Argonne National Laboratory, Argonne, IL |

# D - 2

# 1993 Summer Institute Site Visitors

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# 1993 SUMMER INSTITUTE SITE VISITORS

## THE NATIONAL CENTER FOR IMPROVING SCIENCE EDUCATION STAFF AND ASSOCIATES

Sally Crissman

Joyce Kaser

Paul Kuerbis

Susan Loucks-Horsley

Casey Murrow

Senta Raizen

Judy Sparrow

Suzanne Stiegelbauer

M. Jean Young

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# Appendix E

## Participant Survey Instruments

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# E - 1

# Pre-Participant Information Sheet

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# Pre-Participant Information Sheet

**Date:**

1. **What grade level(s) do you currently teach? (Circle all that apply.)**

Middle School: 5 6 7 8 9

High School: 9 10 11 12

2. **How many years have you taught the following? (Fill in the blank for all that apply.)**

Science ______

Mathematics ______

Vocational/technology ______

3. **Which of the following best describes the ability of the students in your classes? (Indicate how many classes you teach in each category.)**

Fairly homogeneous and low in ability ______classes

Fairly homogeneous and average in ability ______classes

Fairly homogeneous and high in ability ______classes

Heterogeneous, with a mixture of two or more ability levels ______classes

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**4. Rate the following in terms of how important you believe each is in order for your science/mathematics/technology teaching to be effective.**

(Circle one on each line)

| | | Should definitely *not* be included... | | Makes no difference | Should definitely be included... | |
|---|---|---|---|---|---|---|
| a. | integration of science/math/technology | 1 | 2 | 3 | 4 | 5 |
| b. | application of science/math/ technology in daily life | 1 | 2 | 3 | 4 | 5 |
| c. | societal issues related to science/math/ technology | 1 | 2 | 3 | 4 | 5 |
| d. | collaborative/cooperative learning | 1 | 2 | 3 | 4 | 5 |
| e. | use of computers as an integral part of instruction | 1 | 2 | 3 | 4 | 5 |
| f. | discussions of careers | 1 | 2 | 3 | 4 | 5 |
| g. | writing about science/math/technology | 1 | 2 | 3 | 4 | 5 |
| h. | use of hands-on/manipulative/ laboratory activities | 1 | 2 | 3 | 4 | 5 |
| i. | use of scientific equipment/instruments | 1 | 2 | 3 | 4 | 5 |
| j. | students conduct independent research projects | 1 | 2 | 3 | 4 | 5 |
| k. | study of the nature of science and scientific inquiry | 1 | 2 | 3 | 4 | 5 |
| l. | offer breadth of scope the science/ mathematics/technology subject by covering many topics | 1 | 2 | 3 | 4 | 5 |
| m. | emphasis on science/mathematics/ technology facts | 1 | 2 | 3 | 4 | 5 |
| n. | emphasis on mathematical reasoning | 1 | 2 | 3 | 4 | 5 |
| o. | emphasis on fewer concepts (depth versus breadth | 1 | 2 | 3 | 4 | 5 |
| p. | study of vocabulary before engaging in investigations on a topic | 1 | 2 | 3 | 4 | 5 |
| q. | concrete experiences before abstract treatments | 1 | 2 | 3 | 4 | 5 |

What else do you think is especially important to include that is not listed above?

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**5. Indicate the degree to which you agree or disagree with each of the following statements.**

(Circle one on each line)

| | | Strongly Agree | Agree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| a. | I am comfortable with my current level of science/mathematics/technology knowledge | 1 | 2 | 3 | 4 |
| b. | I feel comfortable teaching science/mathematics/technology | 1 | 2 | 3 | 4 |
| c. | I feel comfortable managing a class of students who are doing hands-on activities | 1 | 2 | 3 | 4 |
| d. | I feel comfortable demonstrating science/mathematics/technology principles to my students | 1 | 2 | 3 | 4 |
| e. | I feel confident in my ability to discuss science/mathematics/technology applications with my students | 1 | 2 | 3 | 4 |
| f. | I feel confident in my ability to inform my students of various science/mathematics/technology career opportunities | 1 | 2 | 3 | 4 |
| g. | I feel confident in my ability to help my students answer their own questions | 1 | 2 | 3 | 4 |
| h. | I feel confident in my ability to supervise my students' research projects | 1 | 2 | 3 | 4 |

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**6. Indicate your expectations in regard to the program (either during the program or as a result of your participation).**

| | | 1<br>I do not expect this will occur | 2<br>I am not sure this will occur | 3<br>I expect this will occur |
|---|---|---|---|---|
| a. | observe scientific research in the laboratory | 1 | 2 | 3 |
| b. | increase my science/mathematics/ technology content knowledge | 1 | 2 | 3 |
| c. | increase my knowledge of applications in science/mathematics | 1 | 2 | 3 |
| d. | gain new perspectives on how science/mathematics/technology should best be taught | 1 | 2 | 3 |
| e. | learn about activities I can use in my classroom | 1 | 2 | 3 |
| f. | develop activities I can use in my classroom | 1 | 2 | 3 |
| g. | learn about how to use specific equipment and technologies in my classroom | 1 | 2 | 3 |
| h. | learn laboratory skills that I can teach to my students | 1 | 2 | 3 |
| What other expectations do you have that are not listed above? | | | | |

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# E - 2

# Program Evaluation Form

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# Program Evaluation Form

**Date:**

**Institute Location:**

**1. What grade level(s) do you currently teach? (Circle all that apply.)**

Middle School: 5 6 7 8 9
High School: 9 10 11 12

**2. How many years have you taught the following? (Fill in the blank for all that apply.)**

Science ______

Mathematics ______

Vocational/technology ______

**3. Indicate the extent to which you agree with each of the following statements about what occurred during your participation in the program.**

(Circle one on each line)

| | | Not at All | | | To a great extent |
|---|---|---|---|---|---|
| a. | I increased my science/mathematics/ technology content knowledge | 1 | 2 | 3 | 4 |
| b. | I increased my knowledge of applications in science/mathematics | 1 | 2 | 3 | 4 |
| c. | I gained new perspectives on how science/ mathematics/technology should be best taught | 1 | 2 | 3 | 4 |
| d. | I learned about activities I can use in my classroom | 1 | 2 | 3 | 4 |
| e. | I learned laboratory skills that I can teach to my students | 1 | 2 | 3 | 4 |
| What else occurred that you would like to mention? | | | | | |

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## 4. Rate the following aspects of the program.

(Circle one on each line)

| | | Poor | Fair | Good | Very Good | Excellent |
|---|---|---|---|---|---|---|
| a. | Program administration | 1 | 2 | 3 | 4 | 5 |
| b. | Advance communication | 1 | 2 | 3 | 4 | 5 |
| c. | Orientation | 1 | 2 | 3 | 4 | 5 |
| d. | Availability of resources | 1 | 2 | 3 | 4 | 5 |
| e. | Assistance provided by program staff | 1 | 2 | 3 | 4 | 5 |
| f. | Workshop leaders | 1 | 2 | 3 | 4 | 5 |
| g. | Interactions with other teachers | 1 | 2 | 3 | 4 | 5 |
| h. | Interactions with scientists/ technicians | 1 | 2 | 3 | 4 | 5 |
| i. | Receiving advice and support for sharing experience | 1 | 2 | 3 | 4 | 5 |
| j. | Receiving support for extending experience to the classroom | 1 | 2 | 3 | 4 | 5 |

List any specific strengths and weaknesses you would like the program staff to know about:

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5. **Rate each of the following in terms of its important for effective science/ mathematics/technology teaching to be effective. Answer for the subject (science, mathematics, technology) you spend the most time teaching.**

(Circle one on each line)

| | | Should definitely *not* be included... | | Makes no difference | Should definitely be ...included | |
|---|---|---|---|---|---|---|
| a. | integration of science/math/technology | 1 | 2 | 3 | 4 | 5 |
| b. | application of science/math/ technology in daily life | 1 | 2 | 3 | 4 | 5 |
| c. | societal issues related to science/math/ technology | 1 | 2 | 3 | 4 | 5 |
| d. | collaborative/cooperative learning | 1 | 2 | 3 | 4 | 5 |
| e. | use of computers as an integral part of instruction | 1 | 2 | 3 | 4 | 5 |
| f. | discussions of careers | 1 | 2 | 3 | 4 | 5 |
| g. | writing about science/math/technology | 1 | 2 | 3 | 4 | 5 |
| h. | use of hands-on/manipulative/ laboratory activities | 1 | 2 | 3 | 4 | 5 |
| i. | use of scientific equipment/instruments | 1 | 2 | 3 | 4 | 5 |
| j. | students conduct independent research projects | 1 | 2 | 3 | 4 | 5 |
| k. | study of the nature of science and scientific inquiry | 1 | 2 | 3 | 4 | 5 |
| l. | offer breadth of scope the science/ mathematics/technology subject by covering many topics | 1 | 2 | 3 | 4 | 5 |
| m. | emphasis on science/mathematics/ technology facts | 1 | 2 | 3 | 4 | 5 |
| n. | emphasis on mathematical reasoning | 1 | 2 | 3 | 4 | 5 |
| o. | emphasis on fewer concepts (depth versus breadth | 1 | 2 | 3 | 4 | 5 |
| p. | study of vocabulary before engaging in investigations on a topic | 1 | 2 | 3 | 4 | 5 |
| q. | concrete experiences before abstract treatments | 1 | 2 | 3 | 4 | 5 |
| What else do you think is especially important to include that is not listed above? | | | | | | |

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**6. Indicate the degree to which you agree or disagree with each of the following statements.**

(Circle one on each line)

| | | Strongly Agree | Agree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| a. | I am comfortable with my current level of science/mathematics/technology knowledge | 1 | 2 | 3 | 4 |
| b. | I feel comfortable teaching science/ mathematics/technology | 1 | 2 | 3 | 4 |
| c. | I feel comfortable managing a class of students who are doing hands-on activities | 1 | 2 | 3 | 4 |
| d. | I feel comfortable demonstrating science/mathematics/technology principles to my students | 1 | 2 | 3 | 4 |
| e. | I feel confident in my ability to discuss science/mathematics/technology applications with my students | 1 | 2 | 3 | 4 |
| f. | I feel confident in my ability to inform my students of various science/mathematics/technology career opportunities | 1 | 2 | 3 | 4 |
| g. | I feel confident in my ability to help my students answer their own questions | 1 | 2 | 3 | 4 |
| h. | I feel confident in my ability to supervise my students' research projects | 1 | 2 | 3 | 4 |

# Appendix F

## Participant Survey Instruments:

## Tabulated data[3]

[3]Total responses reflect input from ten out of fifteen Labs/facilities: two Labs did not submit post surveys, one Lab did not submit any pre nor post survey results, one Lab misinterpreted questions and one Lab did not submit pre-survey results.

FCCSET Institutes, Summer, 1993
9/27/93

Pre n = 328 Post n = 338

| Grade Level: pre | | | | | | | |
|---|---|---|---|---|---|---|---|
| Middle School | 148 | High School | 151 | Both | 20 | Elementary | 4 |
| post | 166 | | 148 | | 16 | | 3 |

| Subject: pre | | | | | |
|---|---|---|---|---|---|
| Science | 279 | Math | 158 | Technology | 45 |
| post | 297 | | 170 | | 47 |

**Level of Satisfaction (Post) - Question #4**
**(Figures in Percentages)**

| | 1 Poor | 2 Fair | 3 Good | 4 Very Good | 5 Excellent | Mean | SD |
|---|---|---|---|---|---|---|---|
| a | 0.9 | 3.3 | 14.0 | 35.8 | 46.0 | 4.2 | .87 |
| b | 3.3 | 9.5 | 18.8 | 29.4 | 39.0 | 3.9 | 1.12 |
| c | 0.9 | 7.2 | 18.6 | 38.0 | 35.3 | 4.0 | .95 |
| d | 0 | 3.0 | 11.9 | 33.9 | 51.2 | 4.3 | .80 |
| e | 0 | 0.6 | 4.4 | 27.7 | 67.3 | 4.6 | .58 |
| f | 0.3 | 0.9 | 7.6 | 34.7 | 56.5 | 4.5 | .70 |
| g | 0.3 | 1.2 | 8.9 | 24.9 | 64.7 | 4.5 | .73 |
| h | 0.3 | 1.8 | 10.4 | 30.1 | 57.4 | 4.4 | .77 |
| i | 0.6 | 1.8 | 9.3 | 32.3 | 56.0 | 4.4 | .78 |
| j | 0.3 | 1.8 | 9.0 | 29.7 | 59.2 | 4.5 | .76 |

**Expectations (Pre) - Question #6**
**(Figures in Percentages)**

| | 1 I do not expect this will occur | 2 I am not sure this will occur | 3 I expect this will occur | Mean | SD |
|---|---|---|---|---|---|
| a | 4.8 | 16.6 | 78.6 | 2.7 | .54 |
| b | 1.0 | 7.2 | 91.8 | 2.9 | .32 |
| c | 1.0 | 7.3 | 91.7 | 2.9 | .32 |
| d | 1.7 | 10.8 | 87.5 | 2.8 | .40 |
| e | 0.7 | 10.0 | 89.3 | 2.9 | .34 |
| f | 0.7 | 13.4 | 85.9 | 2.8 | .38 |
| g | 2.1 | 20.4 | 77.5 | 2.7 | .47 |
| h | 4.2 | 20.1 | 75.7 | 2.7 | .54 |

**What Learned (Post) - Question #3**
**(Figures in Percentages)**

| | 1. . . . . . . . . . . . . . . . . . . . . . .4 Not at all | | | To a great extent | Mean | SD |
|---|---|---|---|---|---|---|
| a | 0 | 8.8 | 32.0 | 59.2 | 3.5 | .65 |
| b | 0 | 3.8 | 32.6 | 63.6 | 3.6 | .56 |
| c | 0.6 | 4.7 | 26.9 | 67.8 | 3.6 | .60 |
| d | 0 | 4.2 | 22.2 | 73.6 | 3.7 | .55 |
| e | 2.7 | 13.3 | 31.4 | 52.6 | 3.3 | .81 |

1 = Not at all
4 = To a great extent

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**Comfort Level (Pre) Question #5** | **Comfort Level (Post) - Question #6**

**(Figures in Percentages)**

1—Strongly Agree 2—Agree 3—Disagree 4—Strongly Disagree

| | 1 | 2 | 3 | 4 | Mean | SD | | 1 | 2 | 3 | 4 | Mean | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | 12.9 | 45.8 | 32.0 | 9.3 | 2.4 | .82 | | 19.2 | 52.0 | 23.1 | 5.7 | 2.1 | .79 |
| b | 35.0 | 51.1 | 10.2 | 3.7 | 1.8 | .76 | | 45.2 | 47.0 | 5.1 | 2.7 | 1.6 | .70 |
| c | 49.4 | 42.3 | 5.6 | 2.7 | 1.6 | .72 | | 62.7 | 32.5 | 2.4 | 2.4 | 1.4 | .66 |
| d | 40.3 | 51.0 | 5.6 | 3.1 | 1.7 | .71 | | 56.9 | 36.4 | 4.8 | 1.9 | 1.5 | .67 |
| e | 35.0 | 48.6 | 13.9 | 2.5 | 1.8 | .75 | | 44.3 | 47.3 | 6.0 | 2.4 | 1.7 | .70 |
| f | 23.4 | 50.8 | 21.8 | 4.0 | 2.1 | .78 | | 35.3 | 51.8 | 10.2 | 2.7 | 1.8 | .72 |
| g | 33.3 | 55.5 | 9.3 | 1.9 | 1.8 | .68 | | 45.9 | 47.4 | 4.5 | 2.2 | 1.6 | .67 |
| h | 30.4 | 52.8 | 14.3 | 2.5 | 1.9 | .73 | | 46.1 | 43.4 | 8.0 | 2.5 | 1.7 | .73 |

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| 1 Should definitely not be included... | 2 | 3 Makes no Difference | 4 | 5 Should definitely be included... |
|---|---|---|---|---|

| | Best Practice (Pre) - Question #4 | | Best Practice (Post) - Question #5 | |
|---|---|---|---|---|
| | **Mean** | **SD** | **Mean** | **SD** |
| a | 4.7 | .49 | 4.7 | .50 |
| b | 4.8 | .45 | 4.8 | .46 |
| c | 4.5 | .60 | 4.6 | .66 |
| d | 4.4 | .64 | 4.6 | .61 |
| e | 4.4 | .67 | 4.4 | .65 |
| f | 4.3 | .68 | 4.3 | .73 |
| g | 4.3 | .65 | 4.4 | .71 |
| h | 4.8 | .39 | 4.9 | .41 |
| i | 4.7 | .52 | 4.7 | .49 |
| j | 4.4 | .69 | 4.4 | .67 |
| k | 4.4 | .65 | 4.5 | .66 |
| l | 4.0 | .93 | 4.1 | .96 |
| m | 3.9 | .90 | 3.9 | .96 |
| n | 4.4 | .66 | 4.2 | .74 |
| o | 4.0 | .97 | 4.0 | 1.00 |
| p | 3.7 | 1.00 | 3.8 | .98 |
| q | 4.2 | .78 | 4.3 | .86 |

1 = Should definitely not be included
5 = Should definitely be included

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# Appendix G

## Follow-up Site Visits Schedule

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## Follow-up Site Visits Schedule

| | |
|---|---|
| 12 April 1994 | Smithsonian, Washington, DC |
| 22 April 1994 | Continuous Electron Beam Accelerator Facility, Newport News, VA |
| 23 April 1994 | NOAA Laboratory, Boulder, CO |
| 9 May 1994 | Clemson University and Pee Dee Research and Education Center, Florence, SC |
| 13 May 1994 | NASA Marshall Space Flight Center, Huntsville, AL |
| 18 May 1994 | Sandia National Laboratory, Albuquerque, NM |
| 18 May 1994 | Argonne National Laboratory, Argonne, IL |
| 15 June 1994 | Lawrence Berkeley Laboratory, Berkeley, CA |

## 1993 Summer Institute Follow-up Site Visitors

The National Center for Improving Science Education
Staff and Associates

Sally Crissman

Simon Hawkins

Joyce Kaser

Paul Keurbis

Pat Price

# Appendix H

## Guidelines for Follow-up Site Visitors

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## Guidelines for FCCSET/NSF Follow-up Site Visitors

The assessment study the Center conducted between June and December 1993 documented the FCCSET/DOE Summer Institute programs' intentions to conduct follow-up activity, but could not document what activities were actually implemented, nor their quality and results because most of the activities had not yet occurred. We subsequently were commissioned to examine the follow-up activities that were actually implemented and observe others in process to ascertain their quality and usefulness. Results should enable the program operators to improve the programs and increase the likelihood that the programs have a positive effect on teaching and learning.

There are two purposes guiding this work:

1. To conduct a study of the follow-up implemented by the 15 Summer Institutes and report what teachers have done as a result of their experiences.

2. To identify what follow-up activities were actually done after the Institute to support the learning of Institute participants -- i.e., document what follow-up activities were done, what they entailed (e.g., "looked like"), and what impact they had.

Information To Be Gathered at Site Visit -- Due One Week after Site Visit

1. Complete template Section 5 on Follow-up: Ask the site director to review the intended column for accuracy; then complete the actual column.

2. Complete template questions 1.f. regarding how the program administration ensured effective program follow-up. Ask how the follow-up is organized.

3. Have director fill out the Descriptive and Context Information page at the back of the template. This was not completed in the first study, so we are trying to get that information now.

4. Collect as much information as possible as to the nature of follow-up activities; the impact or perceptions of the teachers served; any anecdotes, etc. that will help us paint a picture of what actually has taken place.

5. Prepare a report to include completed template (section 5 and 1.f), commendations, recommendations, and issues of the follow-up section, capturing any "other" information pertinent. Report should be "meaty," at least two pages in length.

6. Submit this report, completed template, and any materials the Institute has given you as samples of their follow-up work to Sandra Thibodeau at the Andover office within one week of your site visit.

# Appendix I

## Sample Follow-up Questions

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## Sample Follow-Up Questions

Used in telephone and personal interviews of participants in
1993 FCCSET Summer Institutes

What activities were you aware of that followed up the Summer Institute?

Which ones did you participate in?

Could you describe them briefly?

What did you find most valuable about them?

What would you have changed, added, or eliminated?

How have you been able to use the experiences of the Summer Institute in your own teaching?

Has your school supported any changes (new ideas) you brought back from the Summer Institute?

Were you able to share ideas with colleagues at your school or elsewhere?

Have you received direct follow-up help from the Institute staff?

What has that consisted of?

What more should the Institute staff do?

Are there aspects of the Institute and its follow-up activities that are particularly worth mentioning that we have not discussed already? If so, what are they?

## Questions That May Be Useful for the Follow-up Site Visit

### General Follow-up

1. What were the intended formal follow-up activities?
2. What were the actual formal follow-up activities?
3. What percentage of the teachers were involved?
4. Who initiated the activities (teachers, scientists, program staff, etc.)?
5. Who designed the activities?
6. Who implemented the activities?
7. What was the content of the activities (expanding work from the summer, teaching new skills/resources, sharing implementation strategies, etc.)?
8. What were some unplanned follow-up activities:? (See above questions.)
9. How did they measure the follow-up's effectiveness?
10. What problems did they run into with follow-up?
11. What (if any) strategies did they pursue (or contemplate pursuing in the future) to overcome these problems?

### Observed Follow-up Activity

1. What is (are) the group size(s)?
2. What are the goals?
3. How are they measured?
4. What is the mode of discourse (lecture, general discussion, small groups, hands-on activity, etc.)?
5. What is the teachers' role?
6. What did they do (what actually happened)?

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